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Effects of the Wall Street Crisis.

MORE than twenty years ago—twenty-two to be precise—a financial panic in America was the cause of depression throughout the world. Many things appearing to have but the remotest touch with our everyday financial system came to a standstill. Indeed, as we well remember, a brake was put upon enterprise practically everywhere. To-day, when everything has grown to vaster proportions, a somewhat similar state of things has arisen in New York, and observers, whatever their nationality, are beginning to ask: what will be the outcome? Happily we have the assurance of authorities that the results of 1907 cannot be repeated now, thanks to the reform of the American banking system in the intervening years. There has been no other panic of similar description until now, for the financial situation due to the European war comes within a different category.

After the trouble of 1907 had spent itself, anxious observers scanned the horizon with feelings of mingled hope and anxiety for signs of movement in countries far and near, and at last, first hesitating and vague, then more reliable and definite, came indications that confidence was returning—things were moving satisfactorily toward revival. We recorded the nature of the indications in some detail in the ELECTRICAL REVIEW at the time. One of the first signs was the indication of a greater disposition to set afoot business inquiries in distant lands, as shown by the increased receipts of the submarine cable companies. Gradually there followed renewed activity of State and other public departments which had held up development works for a time, and contracts began to flow in to accelerate the rate of revolution of the wheels of industry here and elsewhere.

It was the re-establishment of confidence that was such a difficulty in the process of revival. Can we do anything to-day to prevent loss of confidence resulting in 1929? While it would be useless to hazard prophecy, we feel that unless the situation worsens there is hope to be found in the mere fact of things not being

exactly as they were on the former occasion, but there are some interesting phases of the question which it will be well to watch.

The first effect of the great losses that have been incurred must necessarily be felt in the United States, and as prices may not at the time of writing have reached their lowest, no kind of estimate of the extent of that effect is worth while. When, however, the public, or any large section of it, finds itself so much poorer that it must cut down its purchases, or cease saving and investing, one is naturally led to suppose that there may follow adverse industrial and trading conditions. Already it is reported that motor-car, radio, and other industries are feeling the draught. We all know, however, that the wealth of the United States for some years past, due to various causes, has been fabulous. While that fact may, to some extent, have reduced the force of the blow, it has also been an incentive to extravagant speculation and luxurious spending. This has led to industrial and trading operations of immense proportions—mass production with large available stocks, and so forth. If, however, well-filled stores are not emptied by home demand, the goods must be got rid of in some other way, production must be slowed down and world prices may be affected, upsetting our own and other markets. It is being pointed out that the conditions which have arisen on Wall Street will subject the vast hire-purchase and credit system of the United States, which has grown so rapidly during the past decade, to the severest test that it has ever had. It has been unquestionably responsible for a large share of American prosperity in electrical, motor-car, vacuum cleaner, and other trades. Losers directly affected by the recent slumps, and those indirectly affected by the consequences thereof, may not find it easy to meet their hire-purchase obligations, but, on the other hand, necessity may drive other people to avail themselves of a system which in their prosperity they did not use. It will be remembered that advocates of the system in this country have always quoted a very low percentage loss based on past U.S. practical experience, but those who have been in the habit of regarding hire-purchase in a conservative way will not be slow to quote present American experiences, with a possible change of habit, however temporary, in support of their attitude.

So far as concerns the benefit that the credit payment system may bring to the consumer's branch of the British electrical trade in the future, we are inclined to be optimistic, providing that the system is applied with proper caution and that traders and authorities have adequate financial backing. But it will be profitable to watch its operation in the States during this period of stress.

Among the consequences of Wall Street operations, as Stock Exchange writers and others have been stating, has been the lowering of certain British electricity supply and other electrical shares due to the withdrawal of American buying, and it may be that there will be a temporary slackening of the use of American capital in Europe.

The G.I.P. Railway.

The electrification of the main lines of the Great Indian Peninsula Railway, which is described in this issue, is the second important scheme of the kind to be inaugurated within the British Empire. The first was the Pietermaritzburg-Glencoe section of the South African Railways (Electrical Review, April 15th, 1928) with which it is comparable in magnitude, though possessing many dissimilar features.

Among the advantages expected in India from the change-over from steam are: a considerable reduction in journey time, purer atmosphere in tunnels, a reduction in strain on bridges and in wear and tear of the track, and abolition of the danger of fire to sleepers and neighbouring crops. These advantages are common, to a greater or less degree, to all similar schemes, and will no doubt be properly considered by the present Weir Committee on railway electrification. It is, as experience in the application of electricity to industry has shown, very difficult to set an economic value on such incidental advantages. Experience has, however, undoubtedly proved them to have in general a far higher value than was originally suspected.

Another point having a bearing on the position in this country is that, with the exception of the mechanical parts of 10 out of 65 locomotives, the work was the product of British factories to meet conditions more severe than are experienced in Great Britain.

The Relief of Unemployment.

On a later page we give publicity to the views of the Electricity Commissioners as to the manner in which the electricity supply industry can best assist in solving the unemployment problem. Their suggestions may be summarised as follows—to lay mains in advance of demand, to increase the capacity of distribution systems to meet the larger domestic demand to be expected in the near future, and to develop hire and hire-purchase schemes. The Commissioners also point out the advantage of an early change-over from d.c. to a.c. distribution, having in view the fact that before long most undertakings will receive an a.c. bulk supply from the Grid. As the carrying out of these recommendations will require but a slight intensification of the activity that characterises most progressive undertakings, it is reasonable to suppose that their fulfilment will not prove too onerous in the large majority of cases.

Christmas Trade.

Electrical contractors and retailers are, we hope, well prepared with their arrangements for doing a bumper trade in electrical appliances and contrivances for Christmas and New Year gifts. A large collection of goods suitable for this purpose has been brought before our readers in various domestic and other articles, and in our advertisement pages recently, so that it is not necessary for us to detail them again. What we wish to do more particularly this week is to direct attention to the efforts of the British Electrical Development Association, whose staff has prepared a special series of Christmas window displays. Some reference to them appears in our "Business Notes" pages to-day and we recommend electrical firms and undertakings having showrooms to secure from E.D.A. at once, if they have not already done so, copies of its Monthly Sales and Publicity Programme for December, in which they will find particulars of various Christmas publications and pictures of window dressing aids.

Circuit Breakers Without Oil.

Several attempts have been made during the past few years to develop a circuit breaker of high rupturing capacity without the use of oil. The paper read by Messrs. Wedmore, Whitney and Bruce before the Institution of Electrical Engineers last session (Electrical Review, December 28th, 1928, p. 1132) opens up a wide field of enquiry, provided the necessary funds are available to the E.R.A., and we look forward to the further details then promised us when the patent situation permits. Successful tests were claimed in the U.S.A. for a vacuum circuit breaker, but later information is lacking. A more recent invention, the "Deion" circuit breaker, was described in the Electrical Review of March 29th.

In this number we give an account of a French proposal to substitute gas under pressure for oil. This is based upon the fact that the superiority of oil in dielectric rigidity, heat capacity, and conductability at atmospheric pressure does not apply at higher pressures. One of the advantages claimed is the elimination of the danger of fire or explosion due to the large quantities of oil required in a heavy-duty iron-clad switch. We think, however, that such a fear is far less prevalent than it was; this view is supported by the steady spread of the iron-clad switch from this the country of its origin to other lands.

The Refrigeration of Electrical Apparatus.

A consideration of the possibility of using pressure gas instead of oil for transformers and switchgear, based on a report by Mr. Neu* presented at a conference at Nantes, France.

It can be said without much hesitation that some of the most important problems regarding the development of bulk electricity supply lie in the direction of the limitation of the cost of transforming and control apparatus, with which the question of cooling is closely associated.

The French Professional Association of Producers and Distributors of Power (the Syndicat Professionnel des Producteurs et Distributeurs d'Energie Electrique) of Paris, an undertaking that carries out somewhat similar functions for power companies to those that the I.M.E.A. carries out in our country for municipal undertakings, had these questions before it when Mr. Neu read a paper on the use of refrigerating machinery and high-pressure gas to increase the security of operation of power station and sub-station apparatus.

Mr. Neu points to the paradox that when converting heat into energy one tries to avoid the loss of heat, whereas when one wishes to convert electrical energy into motive power, or convert electrical energy into energy in another condition, one tries to get rid of the heat loss in the process as quickly as possible, as excessive temperatures lead to the limitation of usefulness in the way of output, and reduce the effective life of the apparatus used. In early days atmospheric air was used largely as a dielectric and cooling medium for all classes of electrical apparatus, but increases in capacity and voltages led in the abandonment of air in this double rôle, oil being used in transformers and switchgear and cooled forced draught air in generators and large motors.

If, instead, one has recourse to the low temperatures obtainable with industrial refrigerating plant, it is possible to increase the number of heat calories drawn off, and by lowering the temperature of the electrical material used, the capacity of any given plant can be increased and also security of operation. In Germany, with the aid of refrigeration, an increased output of a transformer of 40 per cent. has been obtained. The lowered temperature of the transformer windings brings about a lower resistance and watts are thus saved; there is no perceptible variation in iron losses; the energy required to run the refrigerating plant is practically balanced by the reduced C^2R losses.

With turbo-alternators, cooling is effected with filtered open or closed air circulation; in America, hydrogen with its superior cooling capacity is being used for such purposes, although such an arrangement is somewhat sensitive and dangerous. One can with advantage, however, cool the circulating air by means of refrigerators and thus increase the alternator output, make the insulation safer, and give greater capacities for overload.

A generating station having refrigerating plant could in summer, at times of lower loads, utilise it for the making of ice, or for the supply of refrigeration services to neighbouring undertakings.

For example, assuming a station with a peak output of 125,000 kVA with generators of the normal type, with circulating air cooled with water coils, and comparing it with one fitted with generators of an output under similar conditions of 100,000 kVA only, then, with the aid of refrigerating plant and extra cooling coils, the latter could give a peak of 125,000 kVA also; calculations show that the capital cost and power costs leave a good margin, especially as the number of hours on the peak per year would be limited. For this class of service steam operated refrigerating plant could be adopted with advantage, utilising the main or separate condensers; water cooling being utilised at low outputs; with steam turbines at very high pressures bled steam could be used for operating the refrigerating plant.

A refrigerating installation operated by steam which requires ejectors and centrifugal pumps only would not lead to sensible complications in a steam generating station.

With regard to transformers, the use of such plant would give comparable results. The transformer capital cost is about half that of an alternator, and the calories to be dissipated per kilowatt would also be about half, so the results would be of the same order, the overload capacity would exceed that of the normal type assumed, namely, 25 per cent.

It is customary to employ oil in high-voltage switches and in transformers; its use is not without serious difficulties and great dangers, oil being essentially combustible and easily inflammable; in large central stations one can measure the oil in hundreds of tons in service. Oil is hygroscopic, special precautions are necessary for its use in service, namely, filtration and drying; its purchase cost is very high; under excessive heating in a coil under oil, bituminous and carbonaceous deposits are formed which give rise to great trouble when repairs are necessary.

In switchgear, when a circuit is opened, oil give rise, by inertia to violent mechanical shocks, resulting sometimes in the bursting of tanks, explosions, and fires, the inertia hindering the rapidity of separation of the moving parts. Many accidents have taken place due to the use of oil; if oil is a useful auxiliary to the electrician it is costly, dangerous, and often objectionable, and the question is, can its use be avoided? The author of the report thinks it can be, as the superiority of oil over air at atmospheric pressure lies in the dielectric rigidity and the greater heat capacity and conductability of the former; this superiority is only present at atmospheric pressure, but it diminishes and becomes negative if the air pressure is sufficiently increased. The researches of Paschem, Cassuto, and Stauescu show that, other things being equal, the dielectric rigidity of gas is such that the explosive potential at a pressure of 6 to 7 kg. per sq. cm. (85 to 100 lb. per sq. in.) is about the same as that of the best quality of oil. The calorific conductability with both systems would be of about the same order. Its measurement is difficult enough with mobile liquids, it becomes more difficult still with a gas, although experience with heated compressed air and steam shows that the calorific conductability of a gas increases rapidly with pressure.

The author therefore puts forward the proposition of replacing the oil in transformers and switches by a gaseous atmosphere at a pressure of several kilogrammes per sq. in. (1 kg. sq. cm. = 14 lb. per sq. in.). That atmosphere would have about the same dielectric

* Contributed by Major Theodore Rich, A.M.I.E.E.

and thermal properties as the oil, without its inconveniences. As gas one could consider air, nitrogen, and carbonic acid gas, the two latter having the advantage of not being carburants. Carbonic acid is a material widely used in commerce in the form of a liquid contained in steel gas bottles; it is used largely for the operation of (lager) beer services in restaurants. One could therefore consider the utilisation of such a system even for small isolated transformer stations, commercial carbonic acid bottles being attached to transformer tanks with automatic valves to make good any gas leakage that might take place. Trip gear might be included to operate on an excessive fall of gas pressure.

The transformer tanks could be built for a pressure of 8 kg. per sq. cm. (113 lb. per sq. in.) and arranged with external cooling coils; they would not be much more expensive than the tanks for oil with vertical oil circulation tubes, current on the market. The circulation of the compressed gas in these tubes would proceed much more easily than with oil, as the coefficient of expansion is so much greater, and its coefficient of friction so much less. This compressed gas could also be cooled with the aid of refrigerating plant.

With circuit breakers there would be no difficulty in the adoption of tanks capable of resisting a pressure of several kg. per sq. in. In a study of Messrs. Boliny and Bennugei made in March, 1927, the work of breaking a short-circuit on the network of the Main Paris Distribution Company, assuming six 15,000-kVA alternators in parallel, was taken as 1,340 kW, for a power of 279,000 kVA; assuming a tank of 150 litres of carbonic acid at 85 lb., the 1,340 kilojoules represents 320 calories, which would give an instantaneous increase of temperature of 640 deg. C., or a pressure of 19 kg. per sq. cm., or 270 lb. per sq. in.

It might be pointed out that the existence of pressure gas in a station would enable the servo-motor operation of switches to be carried out in a way much easier and simpler than with solenoids or electric motors.

The author, Mr. Neu, is of the opinion that:—

(1) Without material modification of the general installation of transformers or alternators, the oil or air circulation system can be energetically cooled with the aid of refrigerating plant, the security and overload capacity of the plant being thereby increased.

(2) In transformers oil could be replaced by gas under pressure cooled either by the usual cooling coils in atmospheric air, or by means of refrigerating plant.

(3) The replacement of oil switches by switches under gas pressure.

It would be of interest to study these questions which would increase output, and improve the operations of plant of large capacity at high pressures, and take away the sword of Damocles which actually hangs over the heads of producers and distributors of electricity who employ oil-immersed apparatus.

During the discussion which took place, the British type of enclosed switchgear was mentioned, but its merits were materially discounted by anxiety regarding the use of still further quantities of inflammable oil, the risks inherent in oil-filled apparatus being realised.

Slide-Rule Calculations.

A Method of Determining Efficiencies within Close Limits.

By L. J. VANN, A.M.I.E.E.

WHILST there are a number of engineers who employ the method of calculation detailed below, there appears to be a large number also who are not acquainted with it. It is hoped, therefore, that for the sake of the interest it may have for the latter, the former will forgive the publication of data already familiar to them.

The efficiency of a machine is generally defined as the quotient of output divided by input. The determination of this value by calculation tends to become laborious, whilst to obtain it directly on the slide-rule is tedious and unreliable, owing to the necessity of reading to four figures at the closer portion of the scale. In nearly every case the efficiency is known approximately, and the object of determining this quotient is to ascertain the third, fourth, and possibly fifth figures. Yet, whilst the first and second figures may be read without difficulty, to obtain a correct reading of the succeeding figures entails considerable care.

To overcome this difficulty, a method is suggested below which enables the efficiency to be determined by a slide-rule reading extending to two only or to three figures, these resulting generally at the coarser end of the scale. It is based on the circumstance that the efficiency tends towards unity in all cases, from which it follows that the difference between unity and efficiency is always a number commencing with noughts or very low figures. Thus, if the efficiency be 0.8865, by subtraction from unity we get 0.1135, which can be read many times more accurately, whilst for an efficiency of 0.9875 we get 0.0125, an even simpler reading.

It will be seen that if a simple connection can be traced between such a figure and a known value it can be determined by slide rule instead of the efficiency and the latter obtained from it by subtraction.

Now let "% total loss" = x
and "100 − % efficiency" = y

Then since "% efficiency" $= 100 \times 1/[1 + (x/100)]$

$$y = 100 - \{100 / [1 + (x/100)]\}$$
$$= (100 + x - 100) / (1 + [x/100])$$
$$= x / (1 + [x/100])$$
$$= 1 / ([1/x] + 1/100)$$

i.e., $y = 1 / ([1/x] + 0.01)$

and $100 - y =$ % efficiency.

Now whereas these formulæ appear less straightforward than that directly defining the efficiency, they can actually be determined with ease and accuracy. The method is as follows:—

Opposite "10" on the D scale bring x on the C scale; read D scale opposite "1" on C scale. Move C scale to the right to increase the reading by 0.01; read C scale opposite "10" on D scale. The resulting value gives y, which by subtraction from 100 gives the efficiency as a percentage.

It will be found that this method permits rapid calculation, as in many cases greater accuracy is possible than is actually necessary. This is exemplified by the case of a 5,000-kVA transformer having an iron loss of 14,000 watts and a full-load copper loss of 46,000 watts. Expressing these as percentages, and reading the corresponding percentages at fractional loads direct from the slide rule we get:—

Output.	Full load.	¾ load.	½ load.	¼ load.
%Iron loss ...	0.28	0.374	0.56	1.12
%Copper loss ...	0.92	0.69	0.46	0.23
x−%Total loss ...	1.20	1.064	1.02	1.35
Adjusting by slide rule as defined above we get:—				
y=	1.187	1.052	1.01	1.331
Whence by subtraction from 100 we obtain:—				
%Efficiency ...	98.813	98.948	98.99	98.669

For commercial purposes these figures may be contracted to:—

Approx. % Efficiency ...	98.81	98.95	98.99	98.67

Wayleaves for Overhead Lines.

Some Notes Arising from Experience in Negotiating Wayleaves for Lines Over Private Property.

By W. A. ROBINSON, A.M.I.E.E.

THE obtaining of wayleaves may, at first sight, appear to be simple, but, in many cases, infinite tact and patience are required in dealing with difficult and often ignorant land owners. Without the exercise of these essential qualities, the engineer will have great difficulty in obtaining the necessary permissions for the erection of a projected overhead line. It must always be remembered that, in making an application for a wayleave, a favour is being asked, and landowners must, accordingly, be treated with appropriate respect. As a general rule, the poorer the education of the owner, the more difficult is the engineer's task.

Speaking broadly, owners and tenants may be divided into three classes:

(1) Those who readily agree to the scheme.
(2) Those who do not agree, but are open to persuasion.
(3) Those who definitely refuse.

It is not necessary to deal further with those owners who fall in class (1) beyond mentioning that their agreement may be due to a genuine desire to be helpful in pushing forward rural electrification, or it may be due to the realisation that the ultimate construction of the line is inevitable, or, more frequently, they want electricity themselves.

In dealing with owners who belong to class (2) the object of the engineer should be to ascertain as soon as possible exactly the point of view of the man he is interviewing with regard to the projected line. The objections that are raised by different people are very numerous. Generally, it is the inconvenience of having the poles in a field which is mentioned, but often it is their unsightliness, and sometimes it is the danger of the live wires. In any case, having found out what the real objection is, the engineer can usually break down the resistance of the owner by pointing out that the objection cannot logically be sustained in view of the advantages to be gained in the country from the manifold uses of electricity. The writer has frequently come across a farmer who will consent to the erection of poles on his land, provided the line also crosses the fields of his neighbour, with whom, perhaps, he has quarrelled. This point of view can, as a rule, be overcome by mentioning that the farmer cannot reasonably expect the line to be diverted so that he may pay off an old score upon his neighbour.

It often happens that an owner will readily agree to the erection of a line on his land if it runs along the hedges and does not traverse his fields. This objection can generally be met by pointing out that, for the sake of strength and efficiency, it is essential for the line to be as straight as possible; moreover, the fewer the angles there are, the fewer will be the number of stays necessary. Another point which may be raised is that it is to the owner's interest to render the construction of the line as economical as possible, so that the price of electricity may be reduced to a minimum. The plea that the presence of the poles and stays in a field is a source of danger to stock may be dealt with by the engineer agreeing to adopt any measures in the way of guarding which the farmer may consider desirable. In addition to the above considerations, the engineer may sometimes gain a point by asserting that electricity is badly needed in the neighbourhood, mentioning names if possible, and suggesting that the farmer himself may at some future date be glad to avail himself of it.

When approaching an owner belonging to class (3) the best course for the engineer to pursue will be to request him to state frankly and precisely why he refuses to give his permission. In most cases he will be unable to make any definite statement beyond saying that he is not going to have his land depreciated in value by the presence of poles, or that it must be quite easy to divert the line so that it does not touch his property. In any case, he refuses to give his consent to the erection of the line.

In general, it will be found best to leave the class (3) owner at this point, and proceed to obtain written consents from the other owners and tenants along the proposed route. When this has been accomplished, the recalcitrant owner can again be approached and told that all the other permissions have been granted, and that the scheme cannot be abandoned because one owner refuses to give his consent. A strong point is to mention that you have been informed in the neighbourhood that he is a public-spirited man and that he would be the last man to stand in the way of progress, or do anything to prevent the benefits of a supply of electricity being brought to the district. Again, it may be said that electricity is being made available for villages all over the country, and that surely he is not going to be the man to deprive his own locality of advantages enjoyed by other districts.

If all these arguments fail to produce the desired result, a stronger line may be taken by explaining that the neighbourhood has asked for a supply of electricity, and you are bound by Statute to provide it. You have carefully surveyed the route, and have decided that the line must pass over his property, so that, if he still refuses, you will have to seek compulsory powers. You may point out that, if he will now give his consent, you will meet his wishes so far as is possible with regard to the positions of the poles, whereas, if compulsory powers are obtained; you will please yourself where the poles are placed. This argument will often achieve success.

A point frequently raised by owners is that the rentals for poles are inadequate and that higher rentals are paid in other districts where they may have property. The only way to deal with this point is to fix definitely beforehand the rentals for arable land and meadows, and not to diverge from them under any consideration. If, in any particular case, a higher rental is offered, the news will soon spread, and innumerable difficulties will arise. It must be pointed out to each owner that the rentals are those prevailing in the district, and have been fixed by a committee and cannot be altered. The same argument applies in fixing compensation for the felling of trees along the route. A definite sum must be arranged as compensation for felling a tree, and this sum must not be altered in any circumstances.

X-ray Congress.

The annual congress of the British Institute of Radiology incorporated with the Röntgen Society will be held at the Central Hall, Westminster, on December 4th, 5th, and 6th, during which time there will be a full trade exhibition of X-ray apparatus. The Silvanus Thompson and Mackenzie-Davidson Memorial and other lectures will be given in the congress hall adjoining the exhibition.

The G.I.P. Railway.

Electrification of the main lines from Bombay to Poona and from Bombay to Kalyan: the lines traverse difficult mountainous country and constitute the most extensive railway main-line electrification scheme within the British Empire.

THE electrified main-line system of the Great Indian Peninsula Railway, an important part of the Indian State Railways, was opened on November 5th by His Excellency the Governor of Bombay (Sir Frederick Sykes). A previous reference to this line was made in the ELECTRICAL REVIEW of October 18th, when some general particulars of the scheme were given.

The electrified system, fig. 1, consists of three sections, *viz.*, the suburban, from Bombay to Kalyan (33 miles of quadruple track); south-east, from Kalyan to Poona over the Bhore Ghat (87 miles of double track); and north-east, Kalyan to Igatpuri (50 miles of double track).

The Ghats have always restricted communication between Bombay and the rest of India, and before the completion of the steam railway in 1853 the journey from Bombay to Poona lasted 24 hours. A reduction was then effected to six hours and it is anticipated that in the early future the time taken will be less than three hours. The ruling gradient over both Ghats is 1 in 37. The present scheme is the first instance of main line electrification in India and follows four years after the first suburban electrified line, the Harbour Branch of the same railway at Bombay, with which it is linked up, as it also is with the Bombay, Baroda and the Central Indian Railway.

Fig. 1.—Route Plan of Electrified System.

Kalyan Power Station.—Power required for the railway beyond Kalyan is generated at a station near Kalyan (figs. 2 and 13) with a total plant capacity of 40,000 kW. Power required between Bombay and Kalyan is supplied by the Tata Power Co., Ltd.

The engine room and boiler house structure consists of a steel framework, cased with bricks, the boiler house being at right angles to the engine room. The contract for the building included a passenger and goods lift in the boiler house, a travelling crane in the engine room, and a basement runway. Six boilers are installed, normally fired with coal, each having an economical output of 60,000 lb. of steam per hour and a maximum output of 75,000 lb. of steam per hour at a pressure of 270 lb. per sq. in. and a total temperature of 725 lb. per sq. in. To meet the sudden and considerable fluctuations experienced with a traction load each boiler is in addition fitted with oil-fuel equipment, which is capable of producing an additional 30,000 lb. of steam per hour.

The boiler arches are of the "Liptak" suspended type, and each boiler is fitted with two travelling-grate compartment stokers fed with coal from overhead storage bunkers, a "Lea" type coal meter being fitted to each stoker. The oil fuel before passing to the burners is heated by steam, which is shut off by a thermo-static device when the oil reaches a definite temperature. Each boiler is fitted with four oil burners arranged in pairs at each side of the boiler. The turning of the handwheel to bring the oil firing into action also starts the oil burner forced-draught fans, speeds up the induced-draught fans, and clears out burners and piping with a blast of live steam.

The four boiler feed pumps are of the "Weir" turbine driven type, each capable of delivering 270,000 lb. of water per hour against a pressure of 280 lb. per sq. in. Each of the four turbines exhausts into three high-pressure feed heaters.

A Lassen-Hjört water softening plant provides for the treatment of the make up boiler feed water.

The engine room contains four three-phase, 6,600-volt, 3,000 r.p.m turbo-alternators, which machines are each capable of a continuous output of 10,000 kW at a steam pressure of 250 lb. per sq. in. and a temperature of 700 deg. F., with a maximum output for two minutes of 16,500 kW. Each turbine is complete with its own steam-driven oil pump for starting up purposes, surface condenser, air ejector, and water extraction pump, and the alternator has a self-excited exciter directly coupled to its shaft. In addition there are also two 415-volt, 350-kW, 9,000 r.p.m. non-condensing house turbine sets of the impulse type for the purpose of starting up the station in the first instance and after shut-downs. The alternators are driven through reduction gearing and run at 1,500 r.p.m., and in designing the insulation consideration was given to the fact that the sets may stand idle for long periods in a moist atmosphere.

The pump house (fig. 3) located on the side of the Ulhas River contains three 350-h.p. vertical circulating water pumps with a normal capacity of 16,000 g.p.m. and two of 175 h.p. with a normal capacity of 8,000 g.p.m. The intake is protected by three motor-driven inclined rotary screens. The circulating water system comprises three 42-in. cast-iron pipes, from which the condensing water

Fig. 2.—General View of Kalyan Power Station from the South-East.

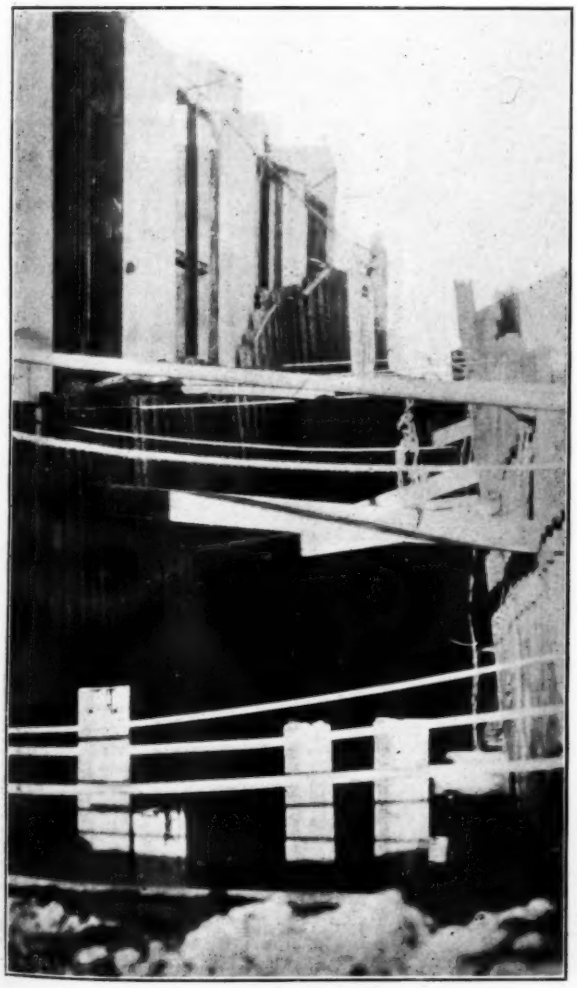


Fig. 3.—Front Wall of Pump House, Kalyan.

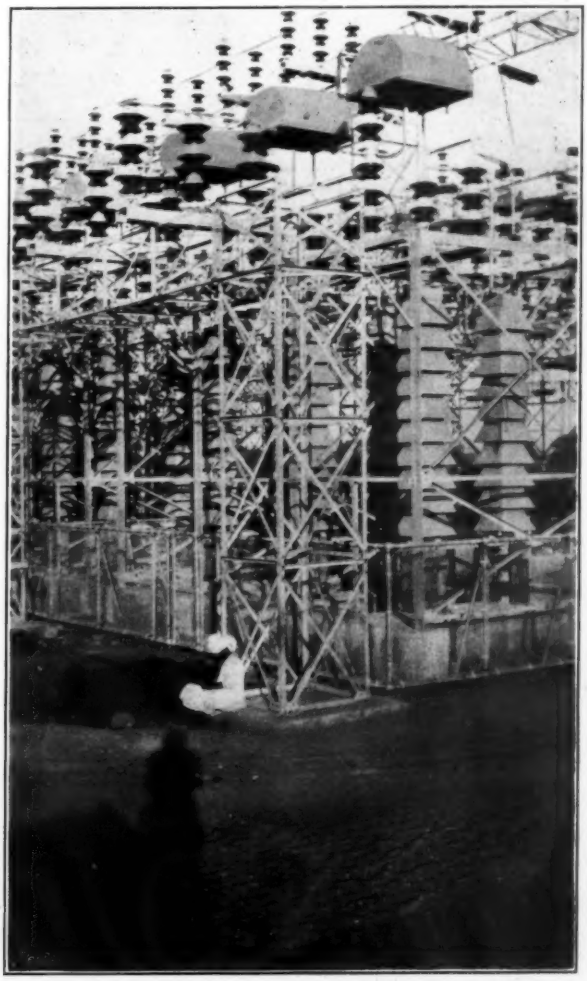


Fig. 4.—Lightning Arrestors.

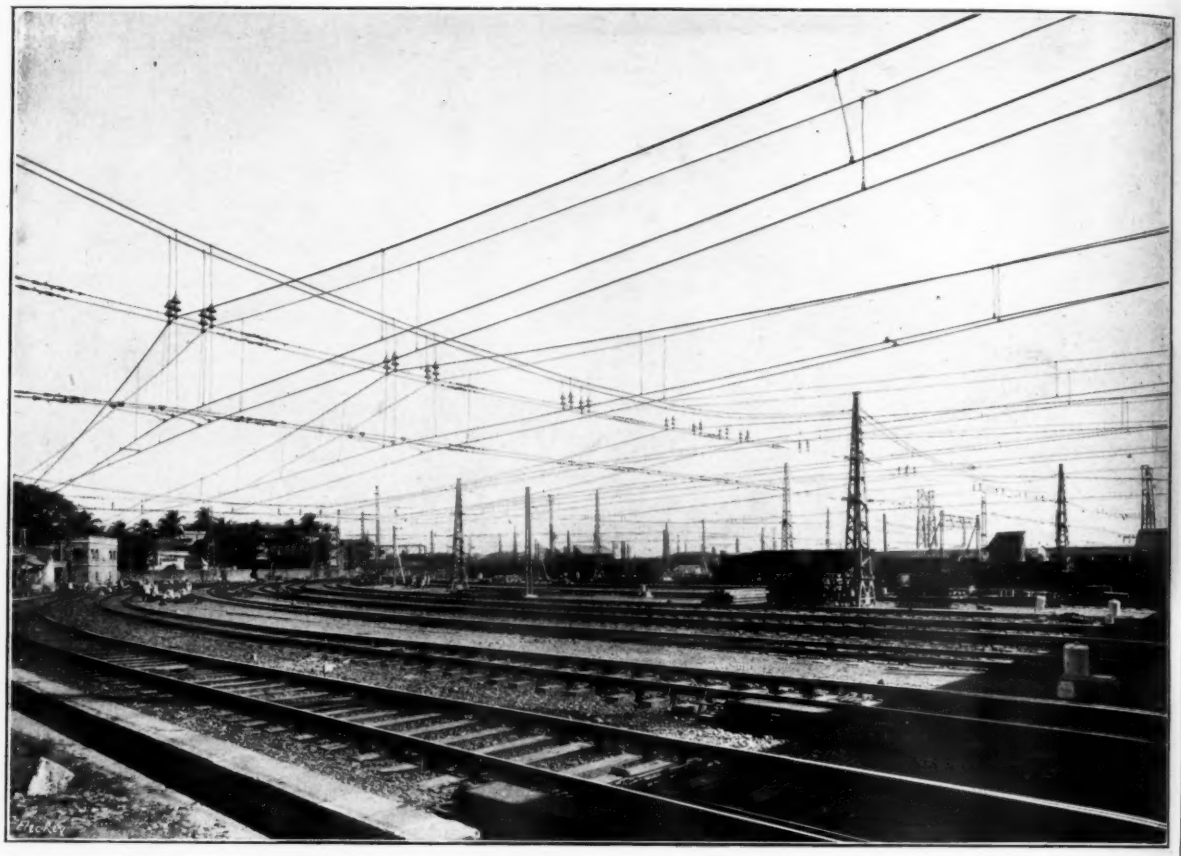


Fig. 5.—Cross Span Equipment, Victoria Terminus, Bombay.

Fig. 6.—Electric Freight Locomotive on Trial Trip.

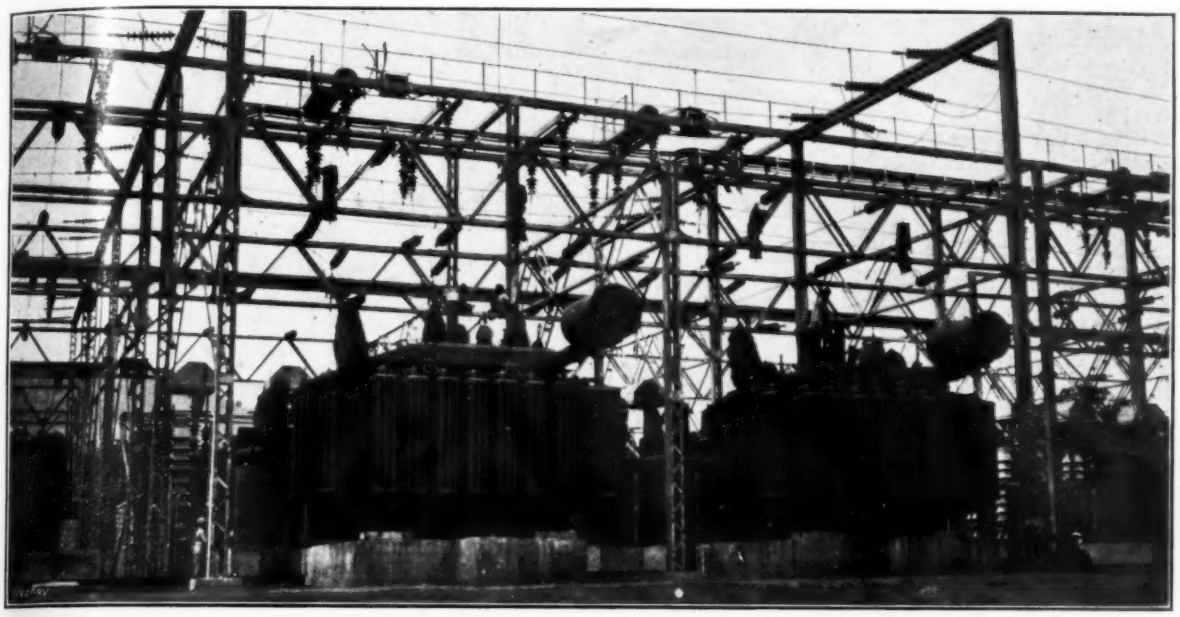


Fig. 7.—Step-down Transformers in an Outdoor Sub-station.

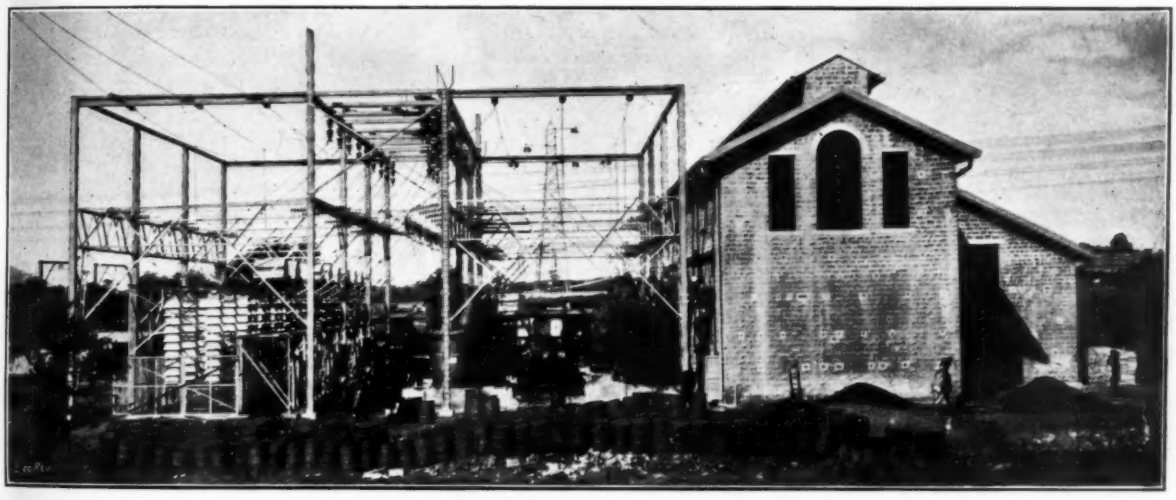


Fig. 8.—Sub-station at Vangani, showing Outdoor Plant.

Fig. 9.—The First Electric Passenger Train from Gonalva to Poona.

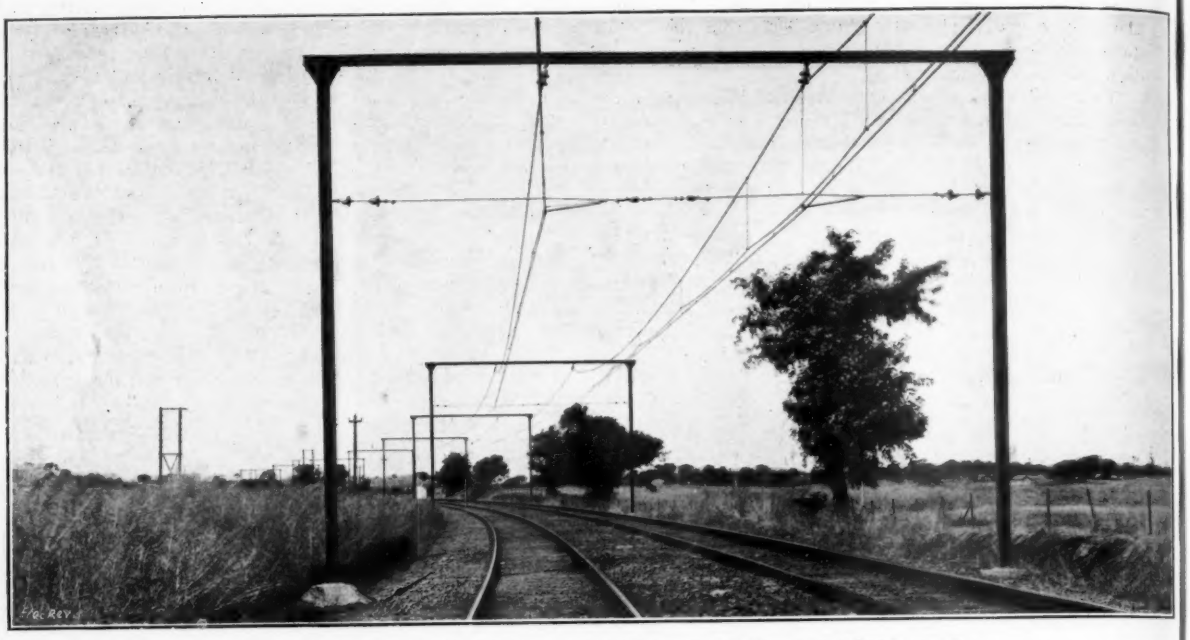


Fig. 10.—Curved Track Construction between Kalyan and Ambernath.

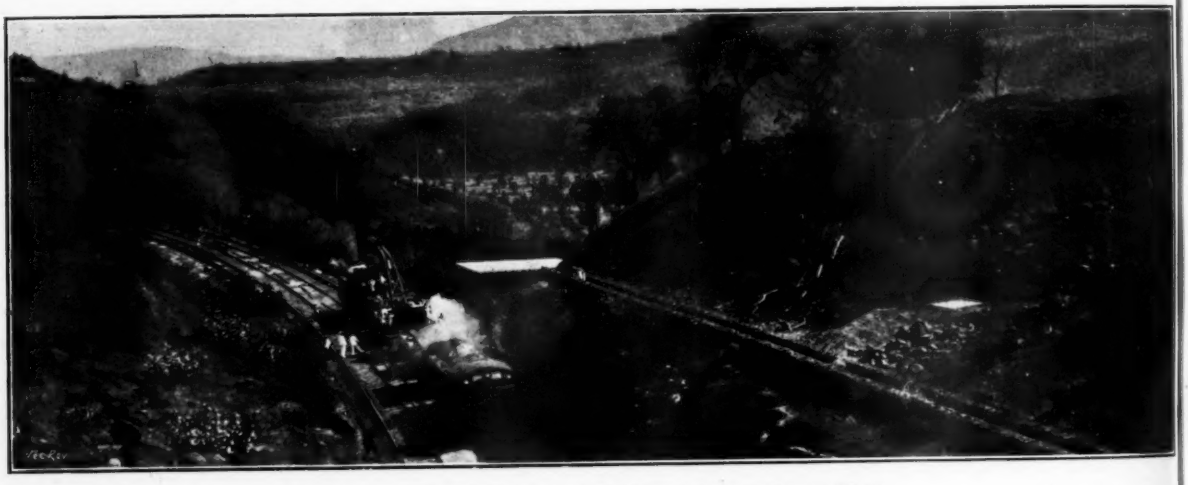


Fig. 11.—Special Train at Cabin on Lower Bhore Ghat.

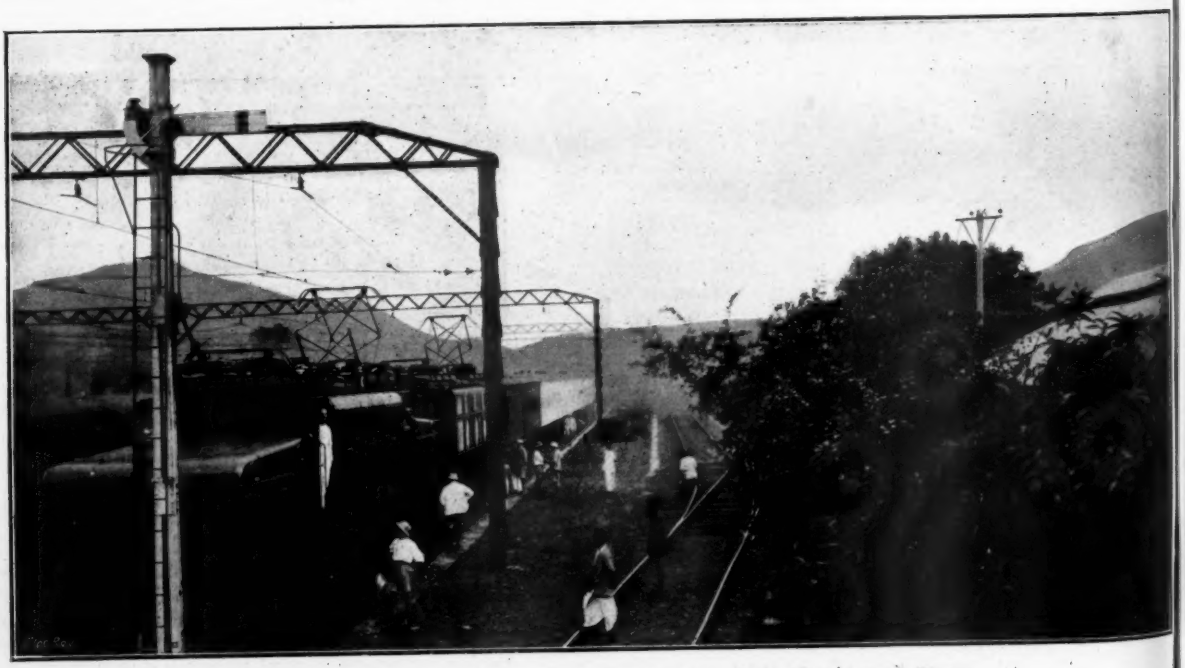


Fig. 12.—Arrival at Karjat of First Electric Passenger Train from Poona.

is conveyed to the outlet further down the Ulhas River. The pumps are electrically controlled from the power station or from the pump house, and are arranged for direct starting at full voltage.

The 6,600-volt switchgear controlling the generators is of the ironclad draw-out type and each generator equipment is housed in a separate cubicle.

The four main 11,000-kVA 6.6/95-kV step-up transformers are situated in an outdoor sub-station adjacent to the power station. Their overload capacity is 18,000 kVA for two minutes. Each step-up transformer forms with its alternator a complete unit, there being no 6,600-volt busbars, and consists of three single-phase transformers.

The e.h.p. outdoor type switchgear has been designed for a pressure of 110,000 volts.

The auxiliary supply for the station is obtained by means of 6,600/415-volt 1,800-kVA unit transformers, one to each generating set and each feeding a separate unit switchboard. The two house turbine sets are also connected to the 415-volt switchgear, which controls the motor-generator equipments and the various auxiliary motors. Four 415/110-volt, single-phase, 25-kVA lighting transformers are installed, and also two 415/110-volt 25-kW motor-generators and a secondary battery for operating circuits, &c.

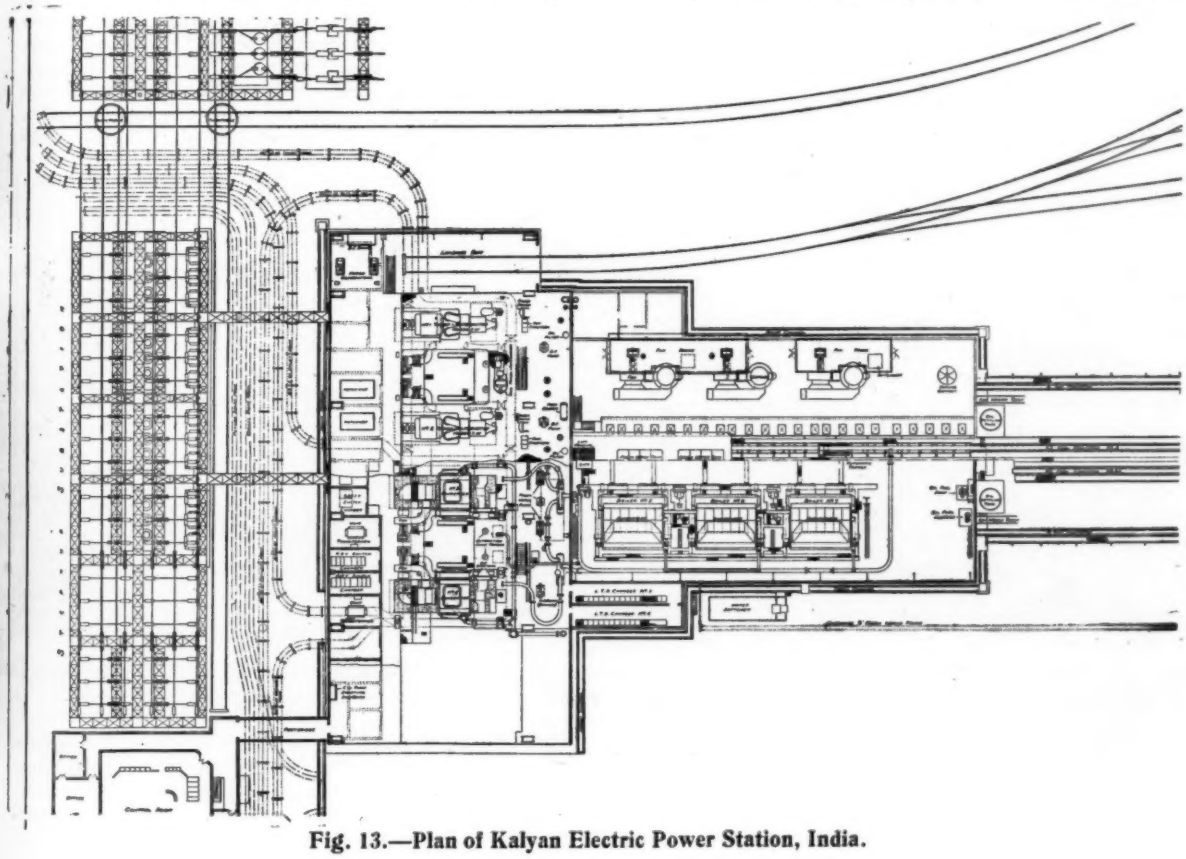


Fig. 13.—Plan of Kalyan Electric Power Station, India.

The coal is discharged into a steel plate receiving hopper situated between a line of standard gauge railway track, from which it is fed by conveyor to a junction tower. From the junction tower two travelling-belt (100 tons per hour) conveyors run to the overhead coal bunkers in the boiler house and one similar reversible conveyor to the coal storage ground. The coal is distributed and reclaimed from the storage ground by a steam-driven jib crane mounted on a caterpillar tractor and capable of dealing with 40 tons per hour.

The ash is continuously discharged from the stokers through chutes into tanks containing water in which paddle wheels operate, the outlets of the chutes from the stokers being sealed to prevent air passing to the boiler combustion chambers. The paddle wheels deliver the ash to two continuously running belt conveyors, each capable of dealing with six tons of ash per hour and extending the full length of the boiler house and terminating in a discharge tower situated above a railway track. As a standby two 10-cwt. ash wagons have been provided.

Transmission Lines.—The transmission lines from Kalyan run on both sides of the railway, except over the Ghat sections, and are situated at such a distance from the railway that no interference with the Railway Post Office telegraph and telephone circuits should be experienced. The separation of the two circuits also minimises the likelihood of damage from storms. This work, which was started in November, 1927, is now nearly completed. The working voltage of this line is between 95,000 and 100,000 volts, being similar to that of the Tata Power Co.'s system. The total length of the transmission lines is approximately 270 miles, and there are some 2,000 towers, each about 75 ft. high, with a normal span of 700 ft. On the Bhore Ghat, it was decided that an additional line should be installed, which could be brought into operation in the event of any trouble occurring on the normally used circuits. In the construction of the line over the Ghat there is a span between towers of 1,750 ft. The conductors consist of stranded aluminium cable with a steel core, and altogether 840 miles of conductor wire was required. It was found more convenient to build the towers up piece by piece, rather than to assemble them on the ground and hoist them into position.

Sub-stations.—The supply of power to the railway track overhead conductors is provided by 11 sub-stations. The average distance between them is about 12 miles. The sub-station buildings have a steel frame and the walls are composed of stonework. The work of erecting the sub-station buildings, track sectioning, and lightning arrestor cabins was carried out by the chief engineer's department.

All the sub-stations, except Thakurvadi, receive their 100,000-volt supply from the power station by means of tee connections from the duplicate transmission lines. These connections terminate on the structure of the outdoor sub-stations, figs. 7 and 8, in which are the 110-kV oil switches and isolators and also the step-down rotary-convertor transformers.

Each rotary-convertor set in a sub-station consists of

two 750-volt rotaries connected in series. A fan mounted on the armature forces over 10,000 cubic feet of filtered air per minute through the machine. Each rotary convertor set has a capacity at a continuous rating of 2,500 kW, *i.e.*, 1,666 amps., for one hour of 2,900 amperes, and momentarily of 6,000 amps.

The 1,500-volt, d.c., high-speed circuit breakers are of the draw-out truck type, and it is anticipated that in addition to rapidly isolating any faults which occur on the overhead equipment they will also prevent damage from lightning. Of the 11 sub-stations, six are operated from the five attended sub-stations by means of a supervisory control system, the wires for which are carried on the structures supporting the track equipment.

Adjacent to the track at each sub-station is a small cabin in which are housed the lightning arrestors (fig. 4) for the protection of sub-station equipment. Midway between each sub-station is situated a track sectioning cabin which contains four high-speed circuit breakers, of a similar type to those in the sub-stations, for interconnecting the tracks so as to make the highest possible use of the track copper conductivity. These cabins are under the control of adjacent sub-stations.

of the conductor are of copper or some other non-ferrous metal.

Some 8,000 tons of steelwork is required for supporting the equipment, and about 3,200 tons of copper is required in the form of conductors alone.

The relative cost of the overhead equipment of the permanent way can be gauged from the fact that, out of a total expenditure on the electrification scheme of about £8,000,000, the cost for this portion came to £2,000,000.

The equipment is arranged for current collection up to 80 miles per hour.

The return circuit of the current is by means of the running rails, which are bonded by two copper bonds under each pair of fishplates.

The principal contractors and sub-contractors for the electrification scheme were :—Steel framework for power station buildings, boiler house equipment, and coal and ash handling plant, Babcock & Wilcox, Ltd.; engine room plant, C. A. Parsons & Co., Ltd.; pump house, Mirrlees-Watson Co., Ltd.; motors, British Thomson-Houston Co., Ltd.; transformers, Metropolitan-Vickers Electrical Co., Ltd.; switchgear and outdoor sub-station steel-work, English Electric Co., Ltd.; transmission

Fig. 14.—Four-track Anchor Structure equipped with Two Section Switches.

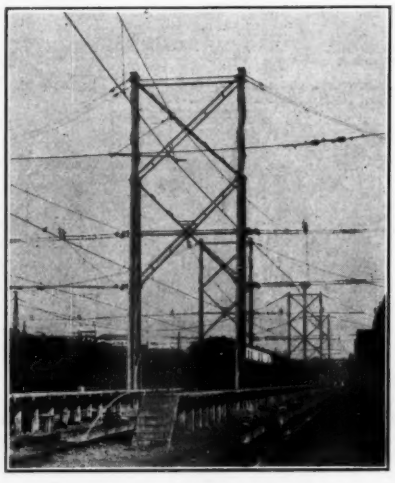


Fig. 15.—Portal Structure at Victoria Terminus, Bombay.

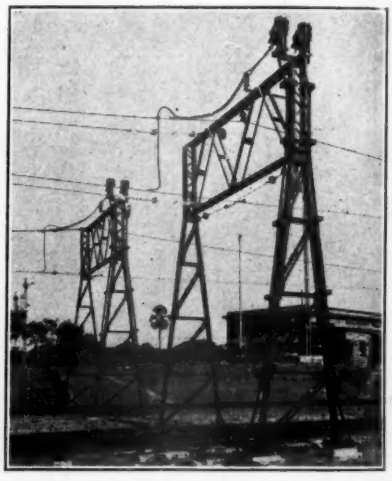


Fig. 16.—Single-track Anchor Structure at Kalyan Feeding Point.

One sub-station at Thakurvadi, about midway up the Bhore Ghat, which, owing to the physical features of the country, could not be fed from the 100,000-volt transmission line, is supplied by means of a 22,000-volt transmission line from Karjat sub-station, where two special outdoor transformers are installed for this purpose.

A special device is installed in the Karjat sub-station which, in the event of the frequency of the system exceeding a predetermined value due to power regenerated by the locomotives exceeding that absorbed by the system will cause artificial load to be thrown on.

Telephone communication with the power controller is available from each sub-station, and no switching operations are carried out except under his instructions.

Overhead Equipment of Permanent Way.—The overhead track equipment (figs. 5, 10, 14, 15 and 16) has several novel features. The total section of copper carried per main-line track is one square inch divided into three parts: .5 sq. in. main catenary, .2 sq. in. auxiliary catenary, and .3 sq. in. contact wire, composed of British standard section wire. The main catenary is suspended at 220 ft. intervals by double porcelain disk insulators of the ball and socket pattern, and the contact wire is suspended by loop type contact wire clips from the auxiliary catenary, thereby providing an exceedingly flexible line. The contact wire and catenaries are tensioned off at approximately every mile, the continuity of contact being made by a patented form of overlap span, which permits some of the tension stresses to be balanced, so reducing to a minimum the amount of steel required in the structures at such points. All metal fittings used for the attachment and suspension

lines, W. T. Henley's Telegraph Works Co., Ltd.; sub-stations and track-sectioning cabins, British Thomson-Houston Co., Ltd.; overhead equipment of permanent way (including suburban section), British Insulated Cables, Ltd.; locomotives, Metropolitan-Vickers Electrical Co., Ltd.

(*To be continued.*)

Levelling Errors in Sub-station Instruments.

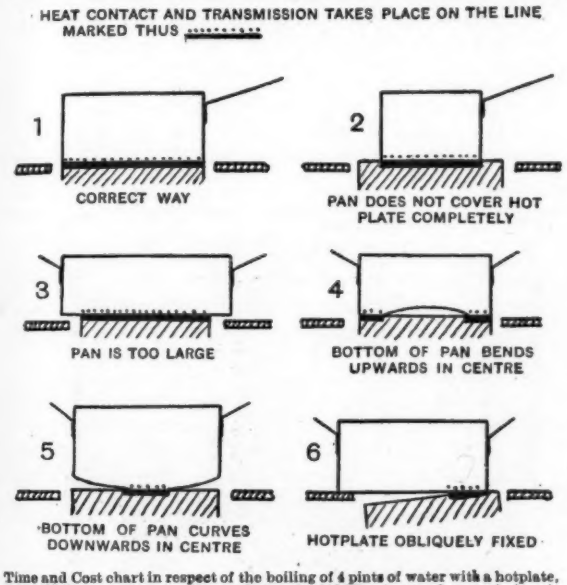
The accuracy of dynamometer type instruments are greatly affected by any departure from the exact level, a variation in accuracy of 0.2 per cent. being caused by such quite small changes as 0.5 or one degree. The error being so small and the cause unsuspected, the inaccuracy is difficult to trace. Therefore Mr. W. E. Warner advises that when testing such instruments the exact level should always be checked, as errors in levelling are a common cause of inaccuracy. The error may have been made when installing the instrument, or have developed in service. The insulating and adhesive varnishes used for impregnating the various parts and for attaching the pivots may easily distort in drying out. They are also affected by the atmospheric temperature, humidity, and the warming due to the electrical load, which cause the inaccuracy to differ on different days and also on different ranges of the instrument. Tests should therefore always be carried out under as nearly identical conditions as possible.

Electricity for the Home.

Examples of manufacturers' recently introduced products, with special reference to the provision of specially designed cooking utensils for use on boiling plates.

Specially Designed Cooking Utensils.

The accompanying graph, fig. 1, sets forth the advantages to be derived from the use of specially prepared utensils in connection with cooking by electricity, and, conversely, the wasteful results which are bound to be produced if the warning is ignored and any old kettle or pan is utilised. It also depicts the proper use, and also the abuse, of the totally-enclosed electric boiling plate, and it supports the view that supply authorities and cooker manufacturers should co-operate in order to educate consumers in how to obtain maximum efficiency at the lowest current consumption. The argument is often advanced by the housewife who has changed over to electric cooking, "why should I go to the further expense of buying new pots and pans when I still have my old ones, which seem to be in quite good condition?" Unfortunately, the salesman is often not sufficiently interested to bring it home to his new client that the acquisition of a totally new set of pots and pans specially manufactured for use with the cooker is not a waste, but an investment which will yield a high interest return in the form of vastly increased efficiency and great saving of time and temper.



Time and Cost chart in respect of the boiling of 4 pints of water with a hotplate, size 8½" diam., with a loading capacity of 1,800 W. Assumed cost of electric current: (a) 1d. per unit; (b) 1½d. per unit.

In order to bring 4 pints of water (taken at 65° F.) to the boiling point of 212° F. it requires.				Efficiency obtained.	Waste of time and expense, based upon the correct figures shown under illustration No. 1.
Sketch.	Time in minutes.	Consumption of energy in watts.	Cost in pence.	Percentage.	
1	9.5	0.282	*a.* 0.282 *b.* 0.423	75	0 (correct)
2	10.75	0.322	*a.* 0.322 *b.* 0.483	65	13
3	13	0.392	*a.* 0.392 *b.* 0.588	54	37
4	23.5	0.705	*a.* 0.705 *b.* 1.06	30	147
5	22	0.665	*a.* 0.665 *b.* 1.00	32	132
6	16.5	0.495	*a.* 0.495 *b.* 0.742	43	74

Fig. 1.—Correct and Incorrect Use of Utensils with Enclosed Boiling Plates.

Careful research work and laboratory experiments with flat-bottomed specially-drawn (not cast) aluminium utensils, as compared with the ordinary type of kettles, pans, &c., now used on gas stoves, have produced results which support the argument that the extra cost entailed by the purchase of a set of suitable utensils is very speedily amortised. The following may serve as an example:—A kettle with ¼-in. thick machined bottom, 8 in. diameter, and containing 3 pints of water, was placed on an 8 in. diameter "Margo" totally-enclosed boiling plate having a loading capacity of 1,600 watts. The contents were brought to boiling point in ten minutes, the current consumption being slightly over ¼ unit. Making the same trial with a boiling plate with a loading of 1,800 watts the water boiled in 8½ minutes. Tests were thereafter made with an ordinary gas kettle, three pints capacity, having an ordinary thin unmachined, but fairly flat bottom, likewise 8 in. diameter. Being placed on a similar totally-enclosed boiling plate (by Messrs. De Brunner & Lang-Sims, 3 & 4, King Street, Covent Garden, W.C.2) 8 in. diameter, with a loading of 1,600 watts, it took 20 minutes to raise the water to boiling point, the current consumption being more than twice what was necessary in the first trial. The tests were continued with this gas-cooker kettle, and it was speedily shown that the consumption necessary to raise the 3 points of water to boiling point constantly increased from trial to trial, inasmuch as the bottom of the utensil began to warp, and the more the bottom became deformed the worse the contact, and, incidentally, the larger the waste and the longer the time to bring the contents to the boil.

Figs. 2 and 3.—Typical Examples of "Margo" Utensils.

These striking figures should readily bring home the only possible conclusion that the saving which can be effected will speedily pay for the cost of the proper implements needed to get maximum efficiency. Figs. 2 and 3 show typical examples of the "Margo" utensils, a half section being depicted in each case.

Another company which is marketing a range of specially designed cooking utensils for use on electric boiling plates is SIGG, LTD., 469, Holloway Road, N. These utensils have ¼-in. thick bottom plates which are machined perfectly flat. The following figures have been obtained by a series of tests with a number of boiling plates using a "Sigg" (inflexible) "Leicester" machined-flat aluminium kettle in each test. The boiling plates were wiped clean of oil, grit, &c., as also was the ground-flat base of the kettle. The loading of the plate was adjusted, irrespective of voltage, to exactly 2,000 watts, and the plate, kettle and water were in each case at 60 deg. F. The following boiling times were obtained:—½ pint, 4 min. 39 sec., 18.8 per cent. efficiency; 1 pint, 5 min. 35 sec., 30.3 per cent. efficiency; 1½ pint, 6 min. 35 sec., 38.6 per cent. efficiency; 2 pints, 7 min. 40 sec., 44.2 per cent. efficiency; 2½ pints, 8 min. 40 sec., 48.7 per cent. efficiency; and 3 pints, 9 min.

45 sec., 52.2 per cent. efficiency. The above tests were made by Revo Electric Co., Ltd., who make the following comments:—" The test results enclosed have been obtained in our own laboratory, where all conditions are under our control, and we can, therefore, vouch for their accuracy. The times given are, we may say, a considerable improvement on anything we have obtained with

Fig. 4.—A " Sadia " Table Stove.

other utensils, and we intend to continue the tests with our other sizes of plates."

Recent " Sadia " Developments.

Among the many recent additions to the products of Sadia, Ltd., 22, Newman Street, Oxford Street, W.1, is a range of boiling plates adapted for table use. The type illustrated in fig. 4, is white enamelled and fitted with a 3-heat switch. It is obtainable in four sizes, *viz.*:—boiling plate diameters of $6\frac{1}{4}$, $7\frac{1}{8}$, $7\frac{7}{8}$ and $8\frac{3}{4}$ in., having respective loadings of 800, 1,000, 1,300, and 1,600 W. Another type is designed to be used as a table plate or an auxiliary plate on any electric cooker. It can be clamped on to the side of a table or hob and is plugged in the same way as an electric kettle. It is made in one size only—$4\frac{1}{2}$-in. diameter plate—and has a loading of 550 W.

An Improved Electric Cooker.

An electric cooker which the Revo Electric Co., Ltd., Britannia Works, Tividale, Tipton, has recently introduced is being used extensively by municipalities in

Fig. 5.—The Revo " Superspeed " Plate.

connection with their domestic supply schemes. This cooker is vitreously enamelled inside and out, but its principle feature is the inclusion, in addition to a " Sadia " plate, of the " Superspeed " plate (fig. 5). The sole purpose of this plate is to provide rapid means of heating small quantities of water. The element is operated through a transformer which reduces the supply voltage to 10 V, and for this low voltage a heavy nickel-chromium resistance wire (0.2 in. diameter) is used. The natural oxide which forms on the surface of the wire is sufficient at so low a voltage to prevent short-circuits. The transformer is of the double-wound pattern. A 3-wire selector switch is fitted on the primary side to provide 3 degrees of heat. The secondary circuit of the transformer is earthed to ensure freedom from shocks which might otherwise occur through capacity. From the transformer, which is placed below the oven, two heavy copper conductors convey the current to the boiling plate. In this circuit laminated cooling fins are provided to prevent the heat from the element being conducted down to the transformer. The extra cost of the transformer is more than balanced, it is claimed, by the absence of repairs to spirals which occur in the ordinary type of boiling plates.

The manufacturers state that additional advantages of the plate are that the red hot visible element appeals to the housewife more than enclosed boiling plates. Owing to the heavy construction of the wire, concentrated heat is attained in a small space, and owing to the freedom from danger of short circuits, the element may be brought extremely close to the base of the utensil.

A New Electric Washer.

The new " Efesca Easy " electric washer recently introduced by Messrs. Falk, Stadelmann & Co., Ltd., 83 to 93, Farringdon Road, E.C.1, is worked on quite a new principle. The washing is done by means of vacuum cups which are attached to tubes and work up and down at the rate of 60 times per minute. These vacuum cups, on striking and rising from the water, create air pressure and ensure, it is claimed, perfect cleaning. Every time the cups reach the bottom of the stroke they change position (twenty times per minute), so that every portion of the washing comes under the action of the vacuum and air-pressure cups. On the up-stroke suction is created, and the clothes at the bottom of the tub are drawn upwards—thus every piece is moved, and thoroughly

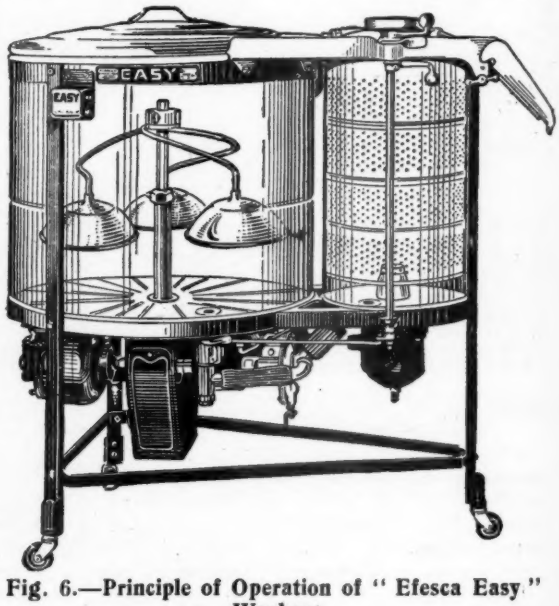


Fig. 6.—Principle of Operation of " Efesca Easy " Washer.

washed. The delicate operation of these cups (which has been likened to the opening and closing of ladies' hands) makes it possible for the most flimsy lace, delicate silk, or the most expensive fabric, to be washed thoroughly without fear of deterioration. The chamber adjoining the washing container is used for drying. This is composed of an inner perforated tank, comprising an up-to-date centrifugal dryer; this dryer can be packed with clothes which will be damp dried ready for ironing or airing in three minutes. This operation is claimed to be far more efficient than any mangle, and buttons cannot be crushed or broken, and no creases will be formed in the washing. It ensures, it is claimed, absolutely even drying without labour, and all the water whirled out of the clothes is returned to the washing tub. To rinse and blue is the work of a few minutes, and the machine can be emptied, either from the exhaust vent provided, or from the draining board, as required, a pump being fitted for this purpose. There is no manual work whatever required for washing and drying—the " Easy " motor and pump undertake all operations. A heating arrangement is fitted under the washing container maintaining the water at the correct temperature during the whole washing operations. The principle of operation of the washer is shown in the accompanying illustration, fig. 6.

Design of Steel Structures.

Mechanical factors to be taken into account when designing outdoor sub-stations.

By H. E. Hutter.

THE following notes are intended to supplement the very meagre literature on the above-named subject, and are based on many years' experience.

The practice in this country is to build structures up to a maximum height of approximately 20 ft. of standard sections, and above that to build entirely of lattice work girders and towers, whilst American practice favours the combination of both.

The structure should be designed on the assumption that all loads act at the same time, so that in that condition excessive deflection may not occur. The pull of the incoming lines should be kept as low as possible, in any case not exceeding 1,000 lb.; if it is wished to keep the weight within reasonable limits, it is much cheaper to place an anchor tower near to the station. The wind loading is a variable factor depending on the location of the station, and should be calculated on 1½ times the projected areas of the steel structure and on the projected area of all apparatus; a good figure for this country which has been used on the grid transforming stations is 25 lb. per sq. ft. The U.S.A. is divided into belts as regards wind and snow loadings, the wind pressures being for the worst district 16 lb. per sq. ft., and for the medium district 13 lb. per sq. ft.

The dead loads are the weights of the apparatus and of one or two men for erection, &c. (weight of a man 200 lb). If considered necessary allowance can be made for the weight of snow on the structure and equipment, and a weight of 5 lb. per sq. ft. could be used in this country. Allowance should also be made for the impact which occurs when mechanically-operated air-break switches are opened and closed, a figure of 40 per cent. of the equipment weight being a sound correction.

Busbars, if of tube resting on post insulators, are taken as a simple dead weight, but, if made up of cable, a tension of 1,000 lb. is barely sufficient to take out the slack in the cable; a figure of 2,000 lb. will meet every case for high-voltage stations, and will also give an allowance for extra loading in bad weather.

The structure can be entirely self-supporting, or rely on diagonal braces for rigidity; a recent example of the latter type is the new transforming station at Dalmarnock, in which there are braces between each bay. A tower having a section of 2 ft. 6 in. square requires bracing, whilst the same structure having legs 4 ft. square is self-supporting.

The steel used in this country is, with the exception of that used for cheap jobs, B.S.S. No. 15, grade A_2 and the most commonly used unit stresses are: bearing on bolts 24,000 lb. per sq. in., shearing stress 12,000 lb. per sq. in., tension 15,000 lb. per sq. in. on net section. The compression stress is usually based on one of the stanchion formulas; a common formula is $17{,}000 \div 70\ L/R$ lb. per sq. in., the ratio L/R being usually limited to a maximum of 125 for main legs, and to 150 for other members having calculated stresses; the minimum thickness of legs should be ¼ in. and for other members 3/16 in., bolts should not be less than ⅝ in. dia., hexagonal heads with lockwashers; the factor of safety against overturning or uprooting should be 21/2.

The bases of columns should be of angle iron and plate not less than ⅜ in. thick, the stress on the concrete not exceeding 150 lb. per sq. in. By far the best way is to use holding down bolts in preference to cementing in the stubs of the columns; the last method requires a high degree of accuracy if the remainder of the structure is to be erected easily; the base plates can be grouted up 1 in. thick after being correctly located.

In order to provide access to the gear, ladders should be placed at suitable places; a ladder composed of side members 2 in. by ⅜ in., 12 in. wide, with rungs at 9 in. centres is ample; alternative methods are bolts in one face of an angle or pieces of angle bolted across a tower.

After the completion of the design the very important point arises as to what finish shall be given. It is impossible to lay down fixed rules, but the two tried methods are coating with zinc by some method, or the use of paint. Usually the best method is galvanising, but sometimes the atmospheric conditions will not permit its use, for instance, in some parts of the Midlands. The most common methods of galvanising are the hot-dip process, in which each piece is treated separately, or the Schoop method, in which the zinc is sprayed on to the sections by means of a pistol, by which means the metal is atomised in a gas flame and blown out by an air jet. The essentials of a suitable paint are that it must remain flexible under all conditions and also be able to resist corrosion; the paints used are those with a bitumen base or else red lead and oil. Nuts, bolts, and washers should be galvanised, the threads of the bolts being either treated with a heavy oil or galvanised.

Reviews.

Cable Research Handbooks. Vol. I. Rules, Regulations and Specifications Affecting the Supply and Distribution of Electricity. Pp. viii+591. Illustrated. London: Commercial Secretaries, Ltd. Price 21s. net.

This handbook is styled "Volume I," which we hope means that it is to be the forerunner of a series of handbooks giving data regarding every aspect of cables. It has been compiled by Cable Research—a body formed in 1927 by eight of the leading cable manufacturers for the purpose of joint research and interchange of information.

As stated in the foreword, the book contains all the more important rules, regulations and specifications governing the manufacture and utilisation of cables and conductors required for the transmission and distribution of electrical energy. The hope which is expressed that "the bringing together of matter hitherto only available in a variety of separate publications will prove of value to everyone interested in cables" will, we are sure, be amply realised.

Such a collection is a reminder of the variety of regulations with which the electrical engineer must comply. Perhaps the example which this volume most clearly shows up is that of the "I.E.E. Regulations for the Electrical Equipment of Ships" and "Lloyd's Rules for Electric Fittings." The latter endorses the former in nearly every respect, but one is left wondering why Lloyd's will not permit a fittings wire less than .001 sq. in. (p. 341) whilst the I.E.E. allows as small as .0006 sq. in. (p. 299) for this purpose. Again it seems strange that Lloyd's accept the I.E.E. Tables of Permissible Currents for Intermittent and Continuous Rating of Cables, but amend that of the maximum permissible for flexibles, see pages 300 to 301 and 356 to 357. Such differences, small though they be, must be irritating and it appears strange that Lloyds cannot accept the I.E.E. Regulations in their entirety.

With one curious exception the compilers have thought it best to include every rule complete with all tables and schedules. This has led to a great deal of repetition. For the most part we agree with their decision, but it seems *somewhat unnecessary* that the overhead line regulations made by the Electricity Commisioners should be printed in full on pages 28 to 30 and again on pages 48 to 53, and a *mistake* to include the obsolete regulations of the same authority on pages 205 to 210 as an appendix to the Home Office Regulations. It also seems hardly necessary to give the tables of resistance and temperature co-efficients in degrees Farenheit three times over, *viz.*, pages 364 to 366, 417 and pages 431 to 433.

The one exception to the compilers' general rule is in connection with the British Standard Specification No. 7 for insulated conductors.

The extract from the glossary which forms part of this specification is omitted and embodied with various other terms and definitions at the end of the handbook. Unfortunately an error has been made in the cross reference on page 362, and in view of the importance of these definitions to the cable user, for whom this book has been compiled, an errata slip should be inserted.

A book of this description will certainly require revising at frequent intervals and we venture to make one or two suggestions for future editions.

First, a headline on each page giving a short title of the regulations or specification dealt with thereon would be of great help.

Secondly, the inclusion of the London County Council regulations for theatres and places of public resort would be a welcome addition.

Thirdly, since a large number of the clientele of the compilers use Continental and American units, a table showing at a glance customary sizes of British, Continental, and American cables in juxtaposition would be of great value. So far as we know there is only one publication in which such a table is given, *viz.*, "Glover's Vade Mecum," which is issued by one of the members of "Cable Research," but, unfortunately, this table is based on the British Standards

of 1910, since when many changes have taken place, including the adoption of the International Copper Standard for Matthieson's.

In conclusion the book is extremely well printed and of handy desk size and is a very welcome addition to the electrical engineer's library.

Telegraphy and Telephony, including Wireless Communication. By E. MALLETT, D.Sc. (Eng.), London. Pp. ix+413; figs. 287. London: Chapman & Hall. Price 21s. net.

In this volume the author has undertaken to provide an outline exposition of the application of scientific principles to the whole art of electro-communication which will serve as an introduction to the specialised manuals on these subjects. A distinct gap is recognised to exist between the elementary type of text-book, which is chiefly concerned with the exposition of the first principles of magnetism and electricity in their practical application to telegraphy and telephony, and the more advanced works on the various branches of these subjects. The book is divided into fourteen chapters dealing successively with: simple apparatus and systems; short lines; transients; long lines; high speed apparatus and systems; alternating quantities; speech apparatus; line transmission; telephonic valves; signalling and switching; electromagnetic waves; high-frequeny circuits; production of transmitting currents; reception; these being followed by an extensive appendix. It will thus be seen that the treatment of the subjects has been so designed that the book will meet the requirements of university or technical college students as well as provide a text-book for those who desire to prepare for the final B.Sc. (Eng.) examination of the London University, the higher grade examinations of the C. and G.I., the entrance examination of the I.E.E., and the examinations of the Civil Service Commissioners.

The author has necessarily been obliged to discriminate between the various systems of telegraphy, and has restricted himself to those only which are likely to conform to examination requirements; but it is not quite apparent why the central-battery duplex system should be omitted while space is given to double plate sounder working, since the latter is now very much obsolescent; nor is it equally apparent why, particularly in conjunction with the "B kick" in quadruplex increment working, no mention is made of the "decrement" system. The "shunted condenser" is investigated mathematically in the chapter on transients, and the well-known relationship $L=KR^2$ obtained—a result which, of course, is never obtained in practice because of the number of variables that enter into the problem. The mathematical demonstration for the theoretical duplex balance given in the appendix will be of interest to those practical engineers who, by empirical methods of their own, obtain balances of extraordinary accuracy. No mention is made of that important quantity the "time-constant" and, although it is implicitly involved in the Helmholtz equation on page 62, it is not explicitly evaluated.

The sections dealing with telephony and line transmission provide the student not merely with the practical aspects of these subjects, but also furnish him with the mathematical investigations by which he should be guided. The final section on wireless is up-to-date and gives an excellent exposition of the latest developments in this particular sphere. The student, however, will not find this book to be one that can be read easily through unless he possesses a good grounding in mathematics, as the author makes constant use of hyperbolic and exponential functions, in addition to the calculus, throughout the entire work. But, given this preliminary requisite, he will be in a position to appreciate the various proofs, step by step, as they are developed throughout the text.

The book is one that more than fulfils the author's modest claim for it, and can be unhesitatingly recommended to those students preparing for the higher examinations in the subjects, as also to those who read the work with the object of specialising in one or other of its branches. The book is excellently printed, and the diagrams are numerous and clearly reproduced.

Theory and Design of Electrical Machines. By F. CREEDY, M.I.E.E., A.C.G.I. Pp. xvi+349; figs. 228. London: Sir Isaac Pitman & Sons, Ltd. Price 30s. net.

"The present treatise represents an effort to reduce the study of the dynamo-electric machine to a scientific form, and to introduce order where, owing to the enormously rapid rate of development, there is little sign of it at present," says the author in his preface. But even Mr. Creedy's genius can scarcely succeed completely in producing order out of chaos. There still remains much for the earnest and enthusiastic plodder, when genius has shown the way. The matter and methods indicated in this book are novel, interesting, and undoubtedly logical, but they leave a too incoherent purview of the wide field covered. Many readers would find the treatment too difficult without an interpreter. The aim of the book is first of all to present the action of electrical machines in a general form—a kind of "electric mechanism"—and to derive the possible commutations and permutations of types, with indications of their possibilities and limitations. In this way, the author surmises, "the development of electrical apparatus might be reduced to a scientific form instead of being left to the haphazard efforts of individual inventors, the success of which is determined by natural selection." In the first part of the book the fundamental equations of the author's system are developed, as a special case of Maxwell's general equations of the electro-magnetic field, and the problems of classification are then dealt with. The idiom used is unusual to the electrical engineer, and the theme is sometimes very difficult to follow. Furthermore, the classification resolves itself into a rather unusual array of types, namely: (1) fundamental types without commutator or variable pole-pitch; (2) commutator motors operating on constant frequency supply; (3) machines operating from variable and multiple frequency generators; (4) cascade sets; (5) multiple-polarity machines; (6) variable-polarity apparatus. That the author has a deep sympathy for, and a wide knowledge of, variable-pole induction machines is clear from the space devoted to these types in the latter part of the book and from his earlier work in this connection. Finally, a universal method of design is given, involving the use of a calculating machine, which will almost feed out a design at one end if supplied with a specification at the other. The equations aim at developing universal expressions applicable to the calculation of any machine, the designer requiring only to apply the necessary empirical data (*e.g.*, space factor in slots) to obtain a solution.

tI is difficult to make an adequate criticism of the book. While it contains a great deal of provocative matter, it may be that the author is a pioneer of what in a few years will be a commonplace. To the advanced student and designer there is much to create thought along distinctly new lines, well deserving of consideration. The advantages of a general survey of the theoretical possibilities cannot be denied, for much time and money in developing unsuitable types may thereby be spared. The treatise Mr. Creedy has given us is clearly the result of years of prodigious labour, and we hope his pioneer work will inspire thinkers both here and abroad.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Current Detector.

A special heat-sensitive mixture which changes from a pale-yellow to a bright-red colour at 100 deg. F. is the secret of a recently-designed current detector. The apparatus consists of a cylindrical metal tube with two contact points similar to those of an electric lamp at one end and sealed at the other end. On one side of the cylinder is a rectangular opening fitted with a mica window, and under the mica is a strip of paper with the word "alive" painted on in the heat-sensitive mixture. Inside the cylinder is a tiny heating element of such ohmic resistance as to require a negligible amount of current to produce the moderate rise in temperature required. On inserting the instrument into a lampholder the element is heated, so causing the lettering to stand out in bright red if the circuit is alive. The lettering remains red for several moments, so that the instrument may be taken from the lampholder into the light, should the room be dark or the holder not easily accessible. The instrument is quite small, weighs only a few ounces, and can be slipped into the pocket without fear of damage. This detector is not yet on the market, as its inventor, Mr. R. Collier, of 1, Elm Park Road, South Norwood, London, has not yet arranged for its manufacture. It is hoped, however, that the device will be available shortly at a very moderate price.

Mercury Contactors.

Interesting claims are made for "Cutax" mercury switches, recently introduced by THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107-111, New Oxford Street, London, W.C.1. With the "Cutax" switch the break takes place in a hermetically-sealed chamber filled with a specially selected inert gas under pressure. The break always takes place between mercury and mercury, the heat of the spark being absorbed by the volatilisation of the mercury. A quartz annular sleeve acts as the insulating medium between the mercury poles of the switch. Any mercury which is volatilised by the arc condenses on the

walls of the chamber, and returns to the sump as soon as the switch is again closed. Owing to the perfect contact which is obtained between the poles of the switch, the 32-A size may be used with perfect safety for closing circuits up to 600 A. This property is valuable in cases where the initial current is much greater than the normal current, as, for instance, in the case of starting up motors, metal-filament-lamp circuits, &c. The power taken by the operating coil is exceptionally low, being 5 watts for direct-current and 6 watts for alternating-current circuits. A particular advantage of the switches is that they take up only a small space. Further, the switch tubes can be supplied without the energising coil or case, enabling manufacturers to incorporate them within their standard equipments. A test on a No. 1 size tube was made over a period of two years, switching a 15-A metal-filament lamp circuit on and off. After operating approximately two million times the switch was dismantled and found to be in perfect condition.

A Novel Lighting-strip Lampholder.

The "Strombo" lighting-strip holder, fig. 1, an invention of Mr. A. E. Howard, 5, High Holborn, W.C.1, is designed

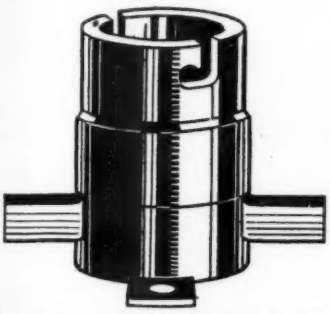


Fig. 1.—The "Strombo" Lampholder.

Fig. 2.—New "Standard" Cell.

for easy assembly on twin-core rubber-sheathed cables, giving a weatherproof connection without the use of insulating compound, &c. It is made in two parts of vulcanite or similar material. One part receives the lamp which can be an ordinary b.c. or s.c. lampholder with two sharp pins which penetrate the sheath and insulation of the cable and make contact with the cores. The second part or base accommodates the cable, and the two parts are held together by means of a common screw-on arrangement. An important point is that the holders can be obtained separately, *i.e.*, *without* the cable, so that contractors can make up their own lighting strip with any desirable spacing of the lampholders. Further, the holders are interchangeable, and the spacing can be altered to any distance required.

An Automatic Commutating Rectifier.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is now supplying a new automatic commutating rectifier called the "Akk-Emmar." It embodies a new and improved method of converting alternating current into direct current, and is claimed to be less expensive and more efficient than driving a d.c. generator by means of an a.c. motor. The apparatus is a light, compact and self-contained outfit, particularly suitable for charging accumulators and for giving single-wave rectification for all non-induction circuits. Special features of the "Akk-Emmar" are the patent automatic polarity changer and the battery automatic cut-in and cut-out which make the operation of the rectifier entirely automatic.

The constructional details include a self-starting synchronous motor having mounted on its shaft extension an external combined commutator and slip-ring and brush gear for rectifying the alternating current, the whole, together with the switchboard, being mounted upon a substantial cast-iron baseplate. The apparatus is manufactured in two models Nos. 2 and 4; No. 2 (20 in. × 25 in. × 13 in.) is suitable for charging all types of accumulators, and No. 4 (26 in. × 26 in. × 13 in.) is specially designed for continuous duty in heavy garage work. They may be described as "fool-proof," requiring no technical knowledge to operate them, and a further feature of importance is that under no circumstances will any interference to wireless reception be caused by their use. A model is also available for double-wave rectification for kinema accumulators, &c.

New "Standard Battery" Products.

We learn that the Standard Wet Battery Co., 184-188, Shaftesbury Avenue, W.C.2, has made further interesting improvements in the construction of its "Standard" wet Leclanché batteries for radio use. The new design takes the form of a cartridge consisting of the sac element or depolariser and zinc in one piece. The cartridge elements are inserted in the jars which have been filled to a certain mark with fluid, after which a tight fitting cork is pressed over the carbon rod and into the neck of the jar. Final assembling is carried out by placing the cells in rows in unibloc trays which hold 32 cells and snapping the zinc lugs, which have holes punched in them, over the brass cap of the carbon rods. The work of fixing up or replenishing parts of the battery is extremely simple, and the greatest economy is effected, due to the fact that only completely used up parts require replacements. Apart from the economy, the reception obtainable from these batteries is the best possible, owing to a total absence of background noises which are liable to occur, due to leakages between cells in the dry type of leclanche batteries. The No. 3 cartridge cells have a capacity of 10,000 mA. and the No. 4 cells of 20,000 mA.

The Standard Wet Battery Co., has also introduced a new three-in-one meter. This is portable and has been designed for panel mounting. To obtain the three readings of 0-150 volts, 0-6 volts and 0-30 mA. a neat bakelite plugging bridge is provided for fixing in the panel with three small plugs. Instructions for plugging-in are provided on an ivorine plate which is also attached to the panel, different coloured disks showing readily the required point, as detailed in the instructions.

Additional to this three-in-one meter, the company has also introduced a single-scale instrument reading 0-25 mA. for panel mounting and a similar model 0-50 mA.

Cartridge Fuses for Underground Work.

A new cartridge fuse, fig. 3, has recently been put on the market by Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1, which provides a very satisfactory protective device against the effects of short-circuits and heavy overloads on distribution systems. These fuses operate at 2.6 times the working current within 30 minutes, whilst they are so designed that they will not blow with twice the working current. One great advantage of this new fuse is that, being interchangeable with the standard link fittings in "Henley" underground disconnecting boxes, it can be inserted, if desired, in existing installations where these boxes are used. The fuses are very robust and yet the requisite degree of strength has been achieved without making them unduly bulky. The fuse consists of a barrel-shaped cartridge with U-shaped brass spring contacts projecting at each end. The cartridge fuse is held in a specially designed fuse carrier

Fig. 3.—The "Henley" Cartridge Fuse.

by screws passing through the U-shaped contacts which also secure the wedge clamping device. It is a simple matter to fit a spare cartridge fuse to the porcelain carrier when a fuse has operated, there being no need to discard the porcelain carrier. In order to tighten the spring contacts, the wedge-shaped pieces are screwed down, using the insulated screwdriver which has been specially designed for this purpose. The arrangement ensures a rigid assembly and a thoroughly efficient contact. The range of sizes includes fuses for working currents from 60 to 300 A, and for use in disconnecting boxes taking up to 0.15 sq. in. and 0.30 sq. in. conductor cables. The fuses have been submitted to exhaustive tests by Henley's Research Laboratories and also by independent testing departments with successful results.

"Sindanyo" Insulating Board.

While "Sindanyo" insulating board is not new and is being extensively used, we feel that its characteristics and properties are not sufficiently widely known to justify the exclusion of the following particulars, which we have obtained from the makers, Messrs. Turner Bros. Asbestos Co., Ltd., Rochdale, from this section. Ebony "Sindanyo" insulating board was first produced to meet the growing need for a scientific product to replace natural materials and satisfy all the requirements of modern electrical engineering. The materials and processes used in its manufacture have been determined so that it might claim to possess properties which, in combination, render it superior to any natural products hitherto used for insulating purposes, although being saleable at a reasonable price. The material is manufactured from an asbestos base. Its electrical

properties are illustrated by the following results of tests carried out by the National Physical Laboratory. Electric strength; r.m.s. volts per inch, 54,000 for 1-in. material and 79,000 for ½-in. material; surface breakdown; 25,000 V (r.m.s.) for all thicknesses. Some of the other factors which are claimed for ebony "Sindanyo" are:—Great resilience, facilitating the distribution and absorption of the impact of heavy modern switchgear, and permitting the use of thinner panels than is necessary in the case of slate or marble; great mechanical strength—tests carried out by the National Physical Laboratory on "Sindanyo" board show tensile strengths of 1,650 lb. per sq. in. (ultimate stress) for 1-in. material, and 2,205 lb. for ½-in. material; light weight, having a saving of about 50 per cent.; uniform thickness, being accurate to within .010 in.; good machining properties—the board can be cut and drilled much more easily than natural products; unfailingly reliable insulation, obviating the usual precautionary bushing of holes for leading through connections; ability to withstand heat, being unaffected by temperatures up to 160 deg. C.; and non-hygroscopic character, as indicated by the following National Physical Laboratory test results: water absorption, percentage increase in weight after 48 hours' immersion; 1-in. material 0.07, ½-in. material 0.06. The board is manufactured in standard sheets, 4 ft. by 3 ft., and in thicknesses ranging from ¼ in. to 2 in. The manufacturers have also developed special plant for supplying switchboards, bases, and all manner of pieces cut to size, bevelled and enamelled, to meet the exact requirements of individual customers, and a large proportion of the sale of "Sindanyo" is actually effected in these finished forms. Three finishes are available, namely, standard, matt, and enamel. It is interesting to learn that "Sindanyo" insulating board has been accepted by Lloyd's Register of Shipping as an approved material for the panels of electrical installations of vessels classed with the Society, and it is employed by leading electrical manufacturers of this country and a considerable number of manufacturers all over the world. The makers have recently published a pictorial booklet which illustrates this fact in a convincing manner by showing photographs of "Sindanyo" insulating board as actually used on apparatus manufactured by a selection of some thirty firms.

Selling Time Switches.

Mr. E. E. Sharp Opens a Discussion at an E.D.A. Conference.

THE monthly Salesmanship Conference of the E.D.A., in London on November 15th, discussed the subject of selling time switches. Sir John R. Brooke (Electricity Commissioner) was in the chair.

Mr. E. E. Sharp opened the proceedings with a lecture, and as he is himself an experienced salesman, his remarks have a wider application than the restricted title would appear to give them, and he was able to give his audience many practical hints concerning the trade. His remarks may be worthy of consideration by all engaged on the selling side of other branches of the industry. As one who knows something of globe-trotting in search of business, it was inevitable that he should bring into his talk some of his overseas experiences. Moreover, although his primary object was to talk of selling time switches this actually occupied the smaller part of the lecture.

Having set out the salesman's attributes of initiative, knowledge of his subject, interest in the consumer, and enthusiasm, as the main qualities of a successful salesman—although he did not suggest that these completed the list—Mr. Sharp was severely critical of schools of salesmanship, the product of which he characterised as filing cabinets, and remarked that when discussing vacuum cleaners, for example, with such a salesman, it was almost possible to watch the index being worked through. On the subject of initiative, he told his audience how his company had a scheme for lending out a specialist salesman in time switches to central stations for a week at a time. This man canvassed the various shopkeepers and got them interested in shop-window lighting after closing hours, and the use of time switches in that connection, without mentioning the name of his own firm. Four weeks before the week's campaign started, an E.D.A. pamphlet dealing with shop-window lighting was sent round to a list of shopkeepers provided by the supply authority; three weeks before, another E.D.A. pamphlet was distributed; two weeks before, yet another; and a week before a letter was sent saying that the representative would call. Thus the ground was well prepared. The representative merely talked of the value of shop window lighting after opening hours, and as a result orders were invariably obtained. Thus the supply authority got additional load, the consumer got a good advertising device going, a contractor usually had to make some small alterations to the installation, E.L.M.A. sold more lamps, E.D.A. sold more "dope," the G.P.O. sold more stamps, and his own firm got an order for time switches.

As to knowledge of the subject, an interesting case was mentioned of an order in which his firm many years ago was underquoted to the extent of £750, and the case was regarded as so hopeless that it was not thought worth while sending a senior member of the firm to deal with the matter. Consequently, Mr. Sharp, then a junior member, was sent down to make a call just to keep in touch with the people. With youthful eagerness, he said, he made a minute study of his firm's and their competitors' instruments, and actually secured the contract after all, and he attributed this solely to his knowledge of the subject. Incidentally, he stressed the importance of knowing as much as possible about all the allied aspects of the particular article being sold, and as an instance mentioned that he tried to keep himself up to date in tariffs in relation to time switches. As a further example of this, he related a story of how when he was in Australia he gave a lecture to a number of engineers in which he described the methods upon which electricity was being developed in this country by the work of the Electricity Commissioners, and the Central Electricity Board and was positive that he received a good deal of business for time switches as a consequence of a display of knowledge which, he added, he might not have "got across" in this country.

Mr. Sharp was very outspoken in his comments as to the failure on the part of too many people actually engaged in the electrical industry to show that enthusiasm which they should do in the case of the greater use of electricity, and, he added, there were many gas engineers who were far more enthusiastic about electricity than were numbers of people actually engaged in the industry. They should not be afraid to use electricity in their homes for every purpose, even if it did cost a little more, if only for the reason that it would be helping the industry from which they drew their livelihood.

The lecturer expressed the view that initiative, knowledge of subject and enthusiasm, would frequently overcome lack of personality, and Mr. Sharp said he would rather have a salesman without a certain amount of personality, than one lacking in the other qualities. He considered that most of those engaged in the industry required a good deal more enthusiasm, courage, initiative and commonsense than had hitherto been evinced. One of the commonest uses of time switches was for shop-window lighting, but for the most part the work was bungled for lack of the virtues he had enumerated. A case was mentioned of a large stores in the district where the speaker lives, where there was some trouble with the time switch. When he went there personally he found the supply company had fixed the switch low down in a cupboard and it was necessary to grovel on the floor to get at it. It was one of the cheapest possible types, quite out of keeping with the size of the installation, and it was connected without a hand switch so that the window lights could not be switched on during the daytime in case of fog or darkness. No instructions had been given as to winding and setting and no key had been left for winding the clock. Moreover, the idea of fitting a time switch had come from the consumer and not the supply company. In the end, Mr. Sharp was able to arrange for the installation of a much better time switch.

There should be no timidity about price; the endeavour should be to carry the customer on a wave of enthusiasm. Just think, he said, of a clock that not only wound itself year in and year out but also changed the time of switching each day so as to follow the sunset time in the district in which it was fixed! All the new telephone kiosks were fitted with such time switches so that it would not be far to take a customer to show him one. Reference was made to the many other uses of time switches, such as for hall lighting when the consumer was out, for operating a buzzer on factory premises at meal times, &c., and in connection with all these it was urged that the salesman should not be obsessed by low price. Incidentally, a case was mentioned in which his firm's price was double that of a competitor, but yet he got the order after a discussion with the engineer concerned and a demonstration of the advantages of his time switch. Incidentally, he mentioned that in one town in New Zealand 7,000 time switches had been installed for water heating purposes during "off-peak" hours and that these were now being connected at the rate of 50 per week.

Discussion.

In opening the ensuing discussion, Mr. V. W. DALE differed from Mr. Sharp with regard to schools of salesmanship, and suggested that there was plenty of room for the school to take in hand those who were born salesmen. In calling attention to any absence of mention by Mr. Sharp of saleswomen, Mr. Dale drew attention to the lack of facilities for teaching women for the sales side of the industry and expressed the hope that the speaker would be able to organise some such facilities. Finally, remarking that he, personally, always made it a habit to add a new piece of electrical apparatus in his house every Christmas. Mr. Dale said that if every one engaged in the electrical industry promised himself a new piece of apparatus every year it would mean a tremendous fillip to the industry all round.

Mr. HAYES asked Mr. Sharp for information as to how to get into the busy retailer or the buyer of a large stores when probably numbers of other salesmen had been trying to get in, and the telephone was ringing, while a customer was also waiting to be seen! Perhaps one difficulty in selling time switches was that the average electrical salesman had to handle so many items that he concentrated on those that were the most easily sold. It might be that we should develop towards specialist salesmen in time. Indeed, he thought he could see a movement in that direction.

Mr. H. W. WATTS (Epsom) expressed the view that the time switch would help a great deal during the next few years in enabling station engineers to cope with the maximum load. He was hoping to get a bulk supply by December, when he would be able to go ahead with water heating and other purposes for which time switches would be required.

Lieut.-Col. W. A. VIGNOLES (Director and Secretary, E.D.A.) remarked that it was not those who attended these conferences that needed to be gingered up, and how to get at those who did not attend, he hardly knew. It must be remembered that their competitors had enormous enthusiasm, from the highest man in their industry to the lowest, notwithstanding that they were selling an inferior commodity to electricity. They realised the importance of salesmanship and everybody in the electrical industry must do the same.

Mr. HAZLETT asked for more information as to the large number of water heaters being installed in New Zealand, as mentioned by Mr. Sharp. There was a distinct demand here for such apparatus, on hire, but it had to be put in at the lowest possible cost and perhaps Mr. Sharp could evolve some apparatus for the purpose.

Mr. H. T. YOUNG contended that although there were some salesmanship schools which could not be recommended there were some where a salesman could learn a very great deal. As to vacuum cleaner salesmen, who had been mentioned, it must be remembered that what often happened in this respect was due to the system of the particular firm and not to the individual. These firms seldom did other than pay the salesman a straight commission without salary or anything else and that was not the way to build up good-will. He suggested that E.D.A. might do something in the direction of keeping a watch on the salesmanship schools that could be recommended.

Miss READING mentioned that the City of London Electric Lighting Co. had put in numerous time switches in City offices in connection with low-temperature heating installations.

The CHAIRMAN remarked that he had never noticed the apathy and cynicism suggested by Mr. Sharp among those who visited the Commissioners. There was, however, a danger on the part of many connected with the industry of assuming that the future lay with electricity without any shadow of doubt, and that they therefore need not trouble very much and could just wait for the world to come up to it. That was a mistake, and from that point of view there was a lack of enthusiasm for convincing outsiders of the value of electrical service.

Mr. SHARP, replying to the discussion, said he was glad to hear there were some good schools of salesmanship, and probably one day he would see one of their products who could convince him, but up to the present he had not. Water heating was an enormous thing for the electrical industry, and as regarded the New Zealand installations, he would give that information privately; it would take some time. The cost of the time switch was only about one-third of a penny per day including capital cost and maintenance, so that it was not a vital item. He doubted whether the industry really appreciated the possibilities of business in time switches. His firm employed 500 people and had up-to-date automatic plant, and the expansion of the business seemed to be purely a question of how fast the firm could grow. He again emphasised the necessity of not being afraid of the low prices of competing makes. Time switches would come into the tariff question very much more in the future, and he saw nothing at all to recommend the maximum-demand system as against the two-rate system.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Personal Salesmanship.

Mr. Walter Buchler writes us on this question as follows:—

"When a principal of a firm or any representative from head office makes a trip overseas, his visit generally leads to extra business coming in. The same policy could well be applied to a greater extent than it is at present in the home markets. Salesmanship is getting better and better, but still the influence of a personal visit from one of the principals invariably creates a better understanding between customers and suppliers, and leads to more orders; at least, that is my experience here and abroad."

This point has been so often referred to that we think that there can be few firms or companies in the electrical industry and trade who fail to appreciate its importance. Many principals of small firms are constantly on the travel, and managing and other directors of big concerns do the same. But principals and directors have other duties and reponsibilities which must be performed if they are to take a live interest in their undertakings. Every important man, whether he travels abroad occasionally to give the business the benefit of his personality, or whether he takes an occasional run round at home, needs an efficient substitute or substitutes; but apart from this aspect of the question there is the crying need for improving the qualifications, status and remuneration of the salesman himself. The report of Government Committee on Education for Salesmanship will shortly appear. Mr. F. W. Goodenough in an address at Birmingham last week said that we needed as a nation a better appreciation of the importance of salesmanship in the high places of the industrial world. To that end there must be suitable education available. The committee which was appointed in October of last year by the President of the Board of Education, includes Mr. P. J. Pybus, Sir G. C. Vyle, and Col. the Hon. Vernon Willey (with Mr. Goodenough as chairman). Its duty is to make recommendations upon the problem of education for salesmanship, and we await its report with interest. We believe with our correspondent that salesmanship is improving, and we appreciate, as we have frequently said, the wisdom of principals or chiefs or men of a special type of personality and qualification suited to their potential customers, going into both the foreign and the home markets supplementing the work of their own salesmen or travellers. We expressed our editorial views on this subject in an article on "Salesmanship Abroad" in the ELECTRICAL REVIEW for October 5th, 1928, an article which those interested in the subject might find it well to re-read at the present time.

The Federation of British Industries and the Effects of Wall Street Panic.

We have received the following notes from the Federation of British Industries since our leading article in this issue was written:—

"The F.B.I. Business Forecast for the Fourth Quarter of 1929, which was written before the Wall Street panic, foreshadowed not only a break in U.S. Stock Exchange securities, but also a major recession in trade, centred in the U.S.A.

"The sudden and dramatic confirmation which the first part of the forecast received, while still in the printers' hands, has

resulted in its second and more important implication being largely overlooked. It is necessary to make clear that the trade recession to which the F.B.I. look forward is something more serious than a mere contraction of luxury expenditure resulting from direct losses in the Stock Exchange slump itself. Their forecast is based on the view that a substantial part of U.S. prosperity during the past two or three years has been built up on an unstable basis due to the inflation of individual expenditure and the general standard of living to a level much above that justified by the *actual* earnings of American citizens. This artificial inflation of expenditure has been made possible by two circumstances :—

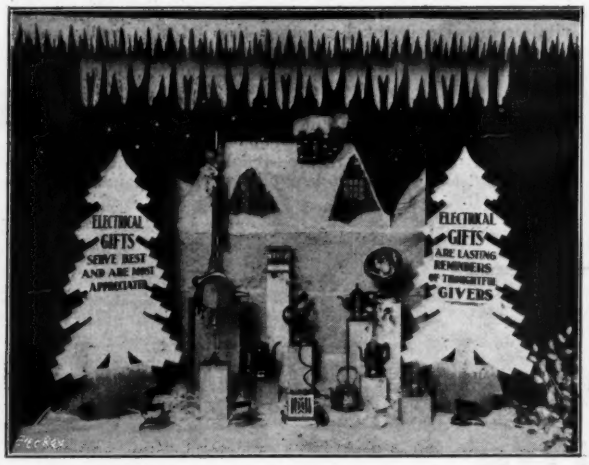
"1. The instalment system which has enabled individuals to mortgage their incomes in advance of earnings.

"2. The expenditure on current consumption of sums made by Stock Exchange speculation, a process which may not unfairly be described as the spending as income of funds which should properly have been devoted to increasing the capital equipment and resources of the U.S.A. and the rest of the world.

"In this respect the present crisis differs markedly from those which occurred in similar periods of 'trade cycle' culmination before the war, which were generally brought about by the converse process, viz., an undue diversion of current income to capital projects. Failure to appreciate this difference is largely responsible for the misunderstanding which appears to prevail regarding the probable industrial consequences of the present movement."

Christmas Window Displays.

The main feature of the December programme of the British Electrical Development Association is a series of Christmas window displays, two of which are illustrated herewith. The designs have been kept as simple as possible in order



Two E.D.A. Christmas Window Displays.

to make it practicable for the smallest showroom to adopt them. Dressing aids for window displays, and a lantern slide of an advertisement of electrical Christmas gifts are available for retailers; also a complete stereo of the advertisement, pierced for the inclusion of the advertiser's name, for use in local press advertisements. The advertising campaign in national newspapers will be devoted mainly to ideas for Christmas gifts, while large displayed "electric homes" advertisements will appear in London and provincial newspapers and leading home journals. A number of seasonal E.D.A. publications are listed in the programme.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting :—

Boyces, Nelson, Lancs.
Mortimer & Gall, London, E.C.2.
Watkins & Richardson, Norbury, S.W.16.
Peacock, Robert, Junr., & Co., Mount Florida, Glasgow.
Raistrick, L., Bradford.
Day, G. W., & Co., Westminster, S.W.1.
Ritchie, A., Glasgow.
Noble, H., Lakenham, Norwich.
Barker & Wilkinson, Harrogate.
Rickards, Charles, Ltd., Paddington, W.2.
Hubbard & Williams, Newton Heath, Manchester.
Ashton, E. R., Heaton Moor, Stockport.
Leek, R. W., & Co., Newcastle-on-Tyne.
Allom Bros., Ltd., Hanover Square, W.1.

At the same meeting ten applications were declined.

Polish Foreign Electrical Trade.

During September last the imports into Poland of "conductors, apparatus and other electro-technical materials" were valued at 8,464,000 zloty (£194,000), while exports of the same class had a value of 84,000 zloty (£1,930).

The Next Imperial Conference.

In view of the forthcoming Imperial Conference in 1930, an arrangement has been come to between the Association of British Chambers of Commerce, the Federation of British Industries and the Chamber of Shipping of the United Kingdom, representing the commercial, industrial and shipping interests of this country, to form a British Preparatory Committee to consider the general question of Empire commercial policy, with the object of co-ordinating as far as possible the views of the business community of the United Kingdom and of presenting to the Government joint recommendations on all questions upon which unanimity of opinion can be obtained.

Contractors' Dance in Aid of the E.T.B.I.

The Birmingham Branch of the Electrical Contractors' Association is holding a dance at Tony's Ballroom, Hurst Street, on November 29th (8 p.m. to midnight), in aid of the E.T.B.I. Tickets (2s. 6d. each) can be obtained from Mr. S. Dagnall (S. Dagnall, Ltd.), 420, Stratford Road, Sparkhill, Birmingham.

Japanese Machinery Import Schemes.

It is reported from Yokohama that certain interests engaged for many years in the importation of German machinery into Japan have prepared a scheme for the direct importation of foreign machinery. This plan proposes to by-pass the foreign agents in Japan whose commissions are said to be high, and to open in the countries concerned Japanese agencies which would deal with the principals.

It is also learned from the same source that Mr. I. Yamanaka, president of the Yamanaka Bank, Tokio, plans the establishment of a company, with a capital of 3,000,000 yen, for the purpose of importing German machines. He is said to have the support of Mr. T. Harada, director of Messrs. Takata & Co., who holds agencies for many German manufacturers.

The German Insulated Wire Industry.

It is estimated that about 50 works in Germany are now engaged in the production of wire conductors, or twice the pre-war number. Competition is keen in the home market, and prices are depressed, while the export trade is difficult. In 1913 Germany exported 20,000 tons of copper wire and about 9,000 tons of covered wire, but in 1928 only 8,400 tons of copper wire were exported. During the current year, however, an improvement has taken place, as up to the end of September 8,800 tons of copper wire were sent out of the country, as well as 10,300 tons of covered wire, the latter comparing with 11,000 tons during the whole of 1928.

Illumination Design Course.

The fourth lecture of the 20th Illumination Design Course took place on November 11th, when Mr. S. Anderson gave a talk on industrial lighting. Amongst other things, the lecturer pointed out the necessity for the avoidance of glare, both direct and indirect, and of hard shadows, whilst the question of maintenance was considered. Sixty members of the electrical trade were present. The fifth lecture took place on November 18th, when Mr. H. Lingard dealt with the question of floodlighting.

Electrical Trades' Commercial Travellers' Association.

The second annual dinner-dance of the Electrical Trades' Commercial Travellers' Association is to be held at the Hotel Cecil, Strand, W.C., on December 11th, when Mr. R. W. Whitley, who has succeeded Mr. J. W. Ward as chairman of the Association, will preside. The price of the tickets is 12s. 6d. each, and these can be obtained from Mr. Ward or any member of the committee.

New Catalogues and Lists.

WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, 43-47, Parker Street, Kingsway, W.C.2.—A well-produced brochure dealing in an interesting manner with high-tension transformers for X-ray work. Some excellent illustrations of the company's products are included.

Messrs. L. G. HAWKINS & Co., LTD., 30/35, Drury Lane, W.C.1.—A sheet showing a selection of the company's products, enclosed in a folder giving particulars of the "Universal 50-50" way of assisting dealers in local advertising.

EDISON SWAN ELECTRIC Co., LTD., 1a, Newman Street, Oxford Street, W.1.—A booklet containing information regarding appropriate lighting of churches. Many illustrated examples of B.T.H. installations are included.

DAVID BROWN & SONS (HUDDERSFIELD), LTD., Park Works, Lockwood, Huddersfield.—A number of illustrated publications giving a full description of various standard types of worm reducing gears.

THE BURLTON INSTITUTE (Miss Gladys Burlton), 30, Manchester Street, London, W.1, supplies a series of fifty bulletins (100 words each) for weekly distribution among selling staffs. A wooden frame is supplied to hold them. A specimen received is entitled "Little Fish are Sweet."

Messrs. J. A. CRABTREE & Co., LTD., Lincoln Works, Walsall.—The latest issue of *The Crabtree* contains, in addition to notes on the company's products, a delightful article by Mr. Crabtree, entitled "Three Memories."

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—A November stock list of the company's products.

KORTING & MATHIESEN ELECTRICAL, LTD., 711 & 715, Fulham Road, S.W.6.—Four new lists, dealing with "Kandem" desk lighting fittings and other local lighting units, lowering gear for lanterns, &c., "Pilolite" fittings for use in hospitals, &c., and "Farlite" lanterns for exterior lighting, &c.

Messrs. ARTHUR LYON & Co., 14, Queen Victoria Street, E.C.—An illustrated brochure describing synchronised electric clocks. Priced.

WHOLESALE FITTINGS Co., LTD., 23, 25, 27 & 37, Commercial Street, E.1.—An illustrated catalogue of electric fires, including dimensions and prices.

WARDLE ENGINEERING Co., LTD., Elsinore Road, Old Trafford, Manchester.—A brochure containing descriptive particulars of "Prismat" bulkhead fittings. Illustrated and priced.

"M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18.—A new comprehensive catalogue (pp. 71) of the company's electrical accessories, including illustrations, dimensions and prices.

Messrs. PHILIP S. SCHULMAN, LTD., "Philora" Works, 76 and 78, Victoria Road, Dickenson Road, Manchester.—A catalogue, illustrated in colour, of the company's wide range of "Philora" lamp shades. Priced.

SUN ELECTRICAL Co., LTD., 118-120, Charing Cross Road, W.C.2.—The catalogue for the season 1929-30 of wireless receivers and components is again a very comprehensive one. It has been considerably enlarged (pp. 224), and contains brief particulars, prices and illustrations of all classes of makes. In addition to the table of contents, reference to any particular component is facilitated by a very complete index.

CRYSELCO, LTD., Kempston Works, Bedford.—A catalogue containing prices and illustrations of Cryselco lamps, and some views of the company's works.

A.E.G. ELECTRIC Co., 131, Victoria Street, S.W.1.—A London stock list of a.c. and d.c. motors, "Furniculus" fires, domestic appliances, &c.

33,000-Volt Cable for Sydney.

On November 3rd five huge drums were taken from the Enfield Cable Works, Ltd., Brimsdown, by the London and North-Eastern Railway to King George V Dock for shipment, per s.s. *Ferndale*, to Sydney. These drums each contain 700 yd. of 3 by .25 sq. in. paper-insulated, separately lead-sheathed cables, laid up, double wire armoured and served, of the 33,000 volts super-tension type. Each drum weighs 28 tons 1 cwt., and is 11 ft. in diameter. It is claimed that these are the heaviest lengths of cable ever made in Great Britain; they will be laid across Sydney Harbour. A special train was required for the transport by rail of these drums, which consisted of five trucks, suitable for heavy machinery, and engine and brake van. Traffic on the down line was suspended while the train made the journey from the factory at Brimsdown.

Fig. 1.—Laying-up Machine Used in the Manufacture of .25 sq. in. Cable for Sydney Harbour.

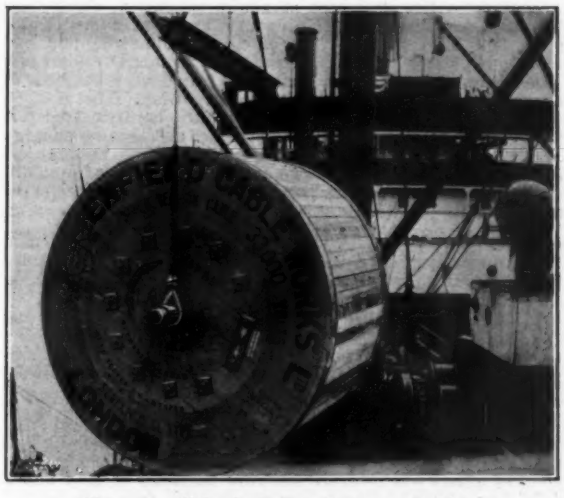


Fig. 2.—Shipping the Sydney Cable.

Trade Announcements.

Mr. ALEXANDER AULD has started business as an electrical engineer and contractor at Wellington House, Alloway Place, Ayr.

Messrs. LOCKHART & MACNAB, electricians, of Stirling, have transferred their electrical fittings and wireless departments from 3, Murray Place, to 34-38, Craigs, where a new showroom has been provided.

The Arrow Electric Division, of Hartford, Connecticut, U.S.A., manufacturers of reciprocating heater switches and general wiring devices, has recently moved to new offices and showrooms at 79, Great Queen Street, Kingsway, London, W.C.2, where it has a stock of switches for the British and West European markets.

Recent Contracts.

Among orders for "Mirrlees-Diesel" engines recently received by Messrs. MIRRLEES, BICKERTON & DAY, LTD., are the following:—The Dabhoi (India) Electricity Supply Co., Ltd., has ordered a two-cylinder, 100-b.h.p. engine, in addition to one of 150-b.h.p. already installed. Callender's Cable and Construction Co., Ltd., has ordered two three-cylinder, 165-b.h.p. engines for the Shiraz (Persia) power station. The Panama Corporation, Ltd., is being supplied with three six-cylinder, 450-b.h.p. engines directly coupled to "G.E.C." alternators. An order has also been received for, *inter alia*, two three-cylinder, 75-b.h.p. engines directly coupled to 50-kW "Brush" generators, for the Montevideo Waterworks Co.

Book Notices.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. November, 1929. No. 325, and Index to Vol. LXVII. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Ralph Stranger's Wireless Library," No. 1, Matter and Energy; No. 2, Electrified Matter; No. 3, Electronic Currents; No. 4, Magnetism and Electro Magnetism; No. 5, The Mathematics of Wireless; No. 6, Batteries and Accumulators. London: George Newnes, Ltd. Price 1s. each.

"Radio Traffic Manual and Operating Regulations," by R. L. Duncan and C. E. Drew. Pp. ix+187; figs. 16. Price 10s. net; "Elements of Radio Communication," by J. H. Morecroft. Pp. x+269; figs. 170. 15s. net; "Electric Street Lighting," by C. J. Stahl. Pp. xi+228; figs. 128. Price 17s. 6d. net. London: Chapman & Hall, Ltd.

Electrical Propaganda at Eastbourne.

The fortnightly meetings held at Eastbourne Corporation Electricity Department's showrooms, at which lectures on the uses of electricity are given, are proving very popular and are attended by between 60 and 100 people. The last three speakers were Mr. H. Lingard, on "Improved Lighting in Workshops"; Mr. V. W. Dale, on "Cooker Construction" and "Taking Greater Advantage of Electrical Appliances"; and Miss C. Haslett, on "Electricity in the Home." The chair is usually taken by Mr. J. K. Brydges, the borough electrical engineer, and we are informed by Mr. F. A. Dracup, the sales manager, that considerable progress has been noted in the hire of cookers and appliances since this series of lectures commenced.

Bankruptcy Proceedings.

Walter Adams, 50, Lee Park, Blackheath, Kent, radio dealer and sign maker.—The first meeting of the creditors was held on November 12th at 29, Russell Square, London, W.C.1. According to the statement of affairs submitted, there were liabilities amounting to £178 against assets of £16. Debtor attributed his failure to lack of capital, ill-health, and bad trade. He stated that in August, 1928, with £25 capital and £75 borrowed money, still owing, he commenced business as a sign maker at 18, Church Street, Greenwich. The business was not successful, and in December, 1928, he discontinued it and commenced business as a radio dealer at the same address. This also was not successful, and in June, 1929, he closed it down. He stated that he had not kept any books of account. The case was left in the hands of the Official Receiver as trustee of the estate.

E. H. Newman and N. Baynes, trading as Langham Radio, wireless manufacturers, 96, Regent Street, W.—The adjourned first meeting of creditors was held last week at the London Bankruptcy Court. Particulars of the failure appeared in our last issue. The Official Receiver reported that the meeting had stood adjourned with a view to the appointment of a trustee, but no nomination had been received. No resolution was passed, and the estate was left in the hands of the Official Receiver.

Joseph Cameroff, 147, Spencer Place, Leeds, electrical engineer.—The public examination was held on November 12th at the County Court House, Albion Place, Leeds, when a statement of affairs was returned showing liabilities of £351 and a deficiency of £335. The debtor ascribed his failure to lack of capital and loss on contracts. The matter was formally adjourned.

Frederick Henry Graham, 14, Hilltop Avenue, Harehills, Leeds, electrician.—The public examination of this debtor was held on November 12th at the County Court House, Albion Place, Leeds, when the failure was attributed to ill-health and lack of capital. The debtor produced a statement of affairs showing liabilities of £245 and a deficiency of £20. The hearing was formally adjourned.

E. E. Peace (Peace & Co.), manufacturing electrical engineers, rear of 230, High Street, Erdington, Birmingham.—Receiving order made November 12th on debtor's own petition.

V. H. Bates (Linton Radio Service), wireless engineer, High Street, Linton, Cambs.—Receiving order made November 11th on debtor's own petition. First meeting November 23rd, at the Official Receiver's office, 41, Sidney Street, Cambridge; public examination December 4th, at the Guildhall, Cambridge.

F. G. Wheeler, electrical engineer, Wychwood, Broadlands Avenue, Shepperton-on-Thames.—Bankrupt's discharge suspended for eighteen months.

S. E. Hunt, electrical engineer and contractor, 8a, Torwood Street, Torquay.—Last day for proofs for dividend, November 29th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

D. Brayshaw, electrician, 78, Granby Street, Liverpool.—First and final dividend of 4s. 7½d. in the £, payable at the offices of the Official Receiver, Government Buildings, Victoria Street, Liverpool.

L. W. Westbury (L. W. Westbury & Co., & Walsall Radio Co.), wireless goods dealer, 146, Lichfield Street, Walsall.—First meeting held November 20th at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton; public examination December 12th at the Court House, Walsall.

H. Holmes, electrical contractor, plumber, &c., 60, Wards-End, Loughborough.—Application for discharge to be heard on December 4th, at the Castle, Leicester.

R. Horsfall (Harrison & Horsfall), electrical engineer, Midland Street, Barnsley.— First and final dividend of 4s. in the £, payable at Standard Buildings, City Square, Leeds.

Company Liquidations.

British Electrical Reproduction Co., Ltd., Lee Valley Road, Ponders End, Middlesex.—A meeting of the creditors was held on November 12th at the offices of Messrs. Whinney, Smith & Whinney, C.A., 4b. Frederick's Place, E.C., when Mr. R. L. Latimer, the liquidator of the company, submitted a statement of affairs which disclosed liabilities of £4,367, of which £2,804 was due to the trade; and there was a sum of £1,285 due to the directors for advances. In addition, there were debentures and interest amounting to £539. They constituted a floating charge on the assets of the company which were estimated to realise £260, leaving the debenture holder an unsecured creditor for £277. There was a deficiency, therefore, as regards the unsecured creditors of £4,367. The liquidator pointed out that the debenture holder was willing to distribute any proceeds he might receive under his debenture to the trade creditors. The voluntary liquidation was confirmed.

Burglass & Jamieson, Ltd., Dundee.—What is believed to have been the first appointment of liquidator in Scotland under the new Companies Act, so far as the electrical trade is concerned, was made on November 6th, when Mr. H. C. McMillan (of Messrs. McMillan & Henderson, accountants, 13, Dundas Street, Glasgow) was appointed liquidator by the above company. The appointment has been confirmed by the creditors. The statement of affairs showed liabilities of £1,918 and net assets of £686, leaving a deficiency of £1,232. The following were appointed a committee of inspection:—Messrs. J. F. Irvine (J. F. Irvine & Co., Ltd.), Paterson (General Electric Co., Ltd.), and Duncan (Wood & Cairns, Ltd.). Messrs. McMillan & Henderson are the secretaries of the Scottish Electrical Manufacturers' and Factors' Association and the British Electrical Trade Protection Association.

Universal & General Radio, Co., Ltd., Bravington Road, W.—A meeting of creditors was held on November 11th at the offices of the liquidator, Mr. H. N. Murray, 7-8, Poultry, E.C. The statement of affairs showed ranking liabilities of £33,152 and net assets of £6,713, leaving a deficiency, so far as the creditors were concerned, of £26,439. It was stated that the preferential claims were heavy, as they included a substantial amount for rent and a claim for income tax. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued, with Mr. Murray as liquidator.

Electromotors, Ltd.—A meeting of members is called for December 18th, at the offices of Messrs. Addleshaw, Sons and Latham, 15, Norfolk Street, Manchester, to hear an account of the winding up from the liquidator, Mr. F. S. Abbott. (It will be well known to our readers that this company has been amalgamated with Laurence Scott & Co., Ltd.)

Accumulators of Woking, Ltd.—A meeting of members is called for December 17th at the offices of Messrs. Tansley Witt and Co., 5, Chancery Lane, W.C., to hear an account of the winding up from the liquidator, Mr. H. Tansley Witt.

Southend Radio Gramophone Co., Ltd.—By order of the High Court, Mr. C. Latham, 78, New Oxford Street, W.C., has been appointed Liquidator in the place of Mr. T. L. Summers.

Dissolution of Partnership.

Van Raalte & Murrey, dealers in antiques, crystal fittings and electrical sundries, 1, Gilbert House, Princeton Street, Holborn, W.C.—Mr. H. A. J. H. Murrey and Mr. L. Van Raalte have dissolved partnership. Mr. Murrey will attend to debts.

Private Arrangements.

James William Abbott, trading as Electrical Engineering and Supply Co., electrical engineer, 26, The Bank, Barnard Castle, Durham.—The creditors interested were called together recently, when a statement of affairs was submitted which showed liabilities of £580 and net assets of £322. It was stated that the debtor had recently suffered from ill-health, and a deed of assignment had already been executed in favour of Mr. H. Wood, C.A., of Newgate, Barnard Castle. The creditors decided to confirm the deed, and expressed the opinion that the trustee should continue the business for a period of six months, which would cover the busy season, and would also give him an opportunity of selling as a going concern.

Deed of Assignment.

A. D. Elliott (deceased), hardware dealer and electrical engineer, 7, Washwood Heath Road and 15, Foxton Road, Alum Rock, Birmingham.—Particulars of claims by December 18th to the trustee, Mr. J. W. Blackham, 147, Corporation Street, Birmingham.

An "Exide" Sound Film.

The Chloride Electrical Storage Co., Ltd., has embarked on a new form of publicity in the production of a sound film. The title is "'Miking' a Talkie," and the chief entertainer is Mr. Tommy Handley. The greater portion of the film aims at the creation of an atmosphere of enjoyment and goodwill in the minds of the hearers, the reference to "Exide" batteries being imparted with the utmost brevity and speed at the end.

A Leicester Window-lighting Demonstration.

An excellent demonstration of shop-window lighting by electricity was arranged at the Bell Hotel, Leicester, on November 13th by Mr. Harry New, on behalf of Philips Lamps, Ltd., who co-operated with the Leicester branch of the Electrical Contractors' Association under the auspices of the Leicester Chamber of Trade. The audience was composed of members of retail associations affiliated to the Leicester Chamber, and there were also present a visiting party of about 70 from the Northampton Chamber of Trade and a large Nottingham contingent from the Distributors' Association and the Electrical Development Association Circle of that city. Mr. F. J. Smith, branch chairman of the E.C.A., presided. The demonstration was given by means of a window case set up in the hall containing every necessary kind of lighting already installed for use.

Belgian Electrical Imports and Exports.

According to a recent return, the imports of electrical machinery and apparatus into Belgium during last year attained a value of £2,407,050, as compared with only £1,649,200 in 1927. Germany is credited with about 30 per cent. of the imports, France with 23 per cent., Holland 16 per cent., Switzerland 8 per cent., the United States 7 per cent., and Great Britain 5 per cent. The exports of similar material from Belgium advanced from £1,704,200 in 1927 to £1,925,500 last year.

Arapuni Scheme Settlement.

It was announced by the New Zealand Minister of Public Works recently that a settlement had been reached between the Government and Sir W. G. Armstrong, Whitworth & Co., Ltd., the original contractors for the Arapuni hydro-electric development. It was provided that the company should receive the scheduled rates so far as was possible for the work already done and an additional £30,000 for the preliminary work.

Receiver Appointed.

ELECTRODRIVES, LTD., Park Royal, N.W.10.—We are informed that the debenture holders have appointed a receiver and manager, who is now in control of the company's business.

Business Budgets.

Mr. A. G. H. Dent delivered an address to the Business Research and Management Association, on November 12th, on "Budgetry Control and Sales Analysis."

Radio Lectures.

The Marconiphone Co., Ltd., has prepared three lectures, each illustrated with lantern slides, dealing with screen grid valves and circuits; a.c. valves and circuits; and public speech and music amplifiers. Each is timed to last from thirty-five to forty-five minutes. The lectures and slides can be obtained from the Marconiphone Co., Ltd., Department I.D., 210-212, Tottenham Court Road, W.1.

Unemployment.

The Ministry of Labour returns showed an increase of 17,600 in the number of unemployed during the week ended November 4th. At that date the total was 1,252,000, as compared with 1,234,388 on October 28th, and 1,349,776 on November 5th, 1928.

New Belgian Company.

A company has recently been formed in Liège with a capital of 10 million fr. and the title La Société Omnium d'Affaires Electriques, to finance electrical undertakings.

Social Event.

The "Clesco" Light Operatic and Dramatic Club of the County of London Electric Supply Co., Ltd., presented an original musical show entitled "Elect Tricks" at King George's Hall, Caroline Street, W.C.1, on November 15th and 16th. The show was in "two phases and 24 shocks," all of which passed through the audience to earth leaving a feeling of exhilaration. The whole production, we were informed, was "home made," and the music by Mr. W. E. Dossett contained many tuneful numbers, while the lyrics by Messrs. A Ashdown and W. E. Dossett were full of humorous lines. The dancing of the eight Electron Girls proved a popular feature, and the staging of the production, under the direction of Mr. H. Frost, was excellent. The appreciation of the audience was shown when, at the fall of the final curtain on Saturday, the gifts of bouquets to the ladies transformed the stage into a miniature flower show. Our thanks to the Club for a pleasant evening.

The Timber Market.

Our Timber Trade Correspondent states that since his last report large shipments of Russian, Finnish, and Swedish wood have come forward, and stocks are now large. Prices generally are in favour of buyers for a time, but will firm up again with the close of navigation in Northern Europe, and with the wearing down of supplies during the coming winter. In the hard and fancy woods section of the trade a notable feature is the smaller supplies of mahogany logs coming forward, thus giving a still better tone to a firm market. Cedar, too, is in small supply, whilst other hard and fancy logs are reaching us in limited quantities at firm rates. Teak is very strong in price, as are also the Empire varieties generally. American woods are still weak, with stocks on hand large. Plywood is arriving in record quantities, and stocks are plentiful.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, November 19th: No change in copper prices.

Messrs. James & Shakespeare report, November 19th: English pig lead, £23 5s., 5s. inc.

Messrs. Edward Till & Co. report, November 19th: India-rubber, Para fine, 8¾d., ¼d. dec.

Reporting on the lead market on November 16th, Messrs. James Forster & Co. said that since the 11th inst. the market had been supported by the Producers' Association, with the result that prices had recovered 15s. per ton from the lowest level touched. The advance was assisted by a better tone in the other metal markets. The American price is unchanged at 6.25 cents. "The heavier arrivals expected have not so far materialised, reports being that metal has been diverted to other ports than London. But for this, producers would have found it difficult to get prices up to the present level as consumers' demand is very quiet, while arrivals, though moderate, are sufficient for current needs. There seems little in the position to justify the present price for the metal, although producers may temporarily maintain or even raise prices further. The Board of Trade returns for October, 1929, are:—Imports, 20,299 tons; exports, 7,315 tons; leaving for home consumption 12,984 tons.

Lighting and Power Notes.

Accrington.—ADMINISTRATION.—The Corporation Electricity and Tramways Committee is to be divided. The two departments are in future to be separate sections and the tramways and 'buses will be under joint control.

Algeria.—ELECTRICAL DEVELOPMENTS.—Considerable development of the electric power supply facilities in Algeria are in progress. In the Algiers district the Société Algérienne d'Eclairage et de Force has decided to erect a new power station with two 12,000-kW turbo-generator sets. In the Oran area, the plant at the Mers-el-Kebir station is to be extended by the addition of a 3,000-kW turbo-generator set, and later by one of 6,400-kW capacity. In conjunction with the Société des Forces Motrices d'Algérie the company is also preparing plans for a power station in the Kabylie area.

Birtley.—PUBLIC LIGHTING.—The Parish Council has received sanction to a loan of £2,600 for converting the public lighting from gas to electricity. Energy will be supplied by the County of Durham Electrical Power Distribution Co., Ltd.

Box.—INAUGURATION OF SUPPLY.—A supply of electricity, provided by the West Wilts Electric Light & Power Co., Ltd., was inaugurated recently. The company has carried out a contract for street lighting.

Burnley.—UNEMPLOYMENT SCHEME.—The Electricity Committee has received approval to an electricity scheme for the relief of unemployment. It provides for the extension of a h.p. feeder from Brunshaw to Plumbe Street; the laying of an e.h.p. feeder from Every Street to Rosehill; and the replacement or renewal of various mains. Tenders for the supply of cables have been accepted.

Buckland.—ELECTRICITY SUPPLY PETITION.—At a meeting held recently of the ratepayers and householders of the parish, it was decided to send another petition asking the Minister of Transport to reject the Dorking Special Order and to grant permission to the Central Electricity Board and the London and Home Counties Joint Electricity Authority to carry out their electricity scheme for the district.

Caernarvon.—TRANSFER OF UNDERTAKING.—The Town Council has decided to take over the electricity undertaking which, since its inception 24 years ago, has been carried on on behalf of the Council by the National Electric Construction Co., Ltd Proposals had been made by the company for renewing the agreement for 10 years, but these were rejected by the Council.

THE DOMESTIC LOAD.—In an address given at Carnarvon a few days ago Mr. Percy White, Bangor borough electrical engineer, expressed the view that ultimately the domestic load would absorb the greater part of the output of all electricity undertakings. In the North Wales area the North Wales Power Co., Ltd., supplied electricity in bulk to 52 authorities. With the facilities that were now available it should be possible to make rapid strides in the development of the heating and cooking load as distinct from the lighting load, particularly as there were hire-purchase schemes for the acquisition of appliances. Load curves were exhibited showing the output of electricity from the Carnarvon supply for summer and winter, which plainly indicated the effect of shop lighting on the consumption of electricity.

Canada.—HYDRO-ELECTRIC DEVELOPMENTS.—The first step towards the development of 250,000 h.p. at Chats Fall, on the Ottawa River, 35 miles north of Ottawa, has been taken by the awarding of a contract to the Marrow and Beatty Company, of Peterborough, for the construction of a 30-ft. dam on the Quebec side of the river. The contract was given by the Royal Securities of Montreal, who control the power rights at this point, and the contract price is understood to be approximately $2,000,000. The work on the Ontario side will be done by the Ontario Government. When completed the dam will stretch across the river for a distance of 1¼ miles, and will constitute the largest single power development on the Ottawa River; it will back up the waters of the river for a distance of between 12 and 15 miles.

Arrangements have been made which will enable work on the construction of the power plant of the Montreal Island Power Co., on Back River, near that city, to be proceeded with. The contract was held by the P. Lyall Construction Co., of Montreal, which recently went into liquidation. On account of the urgency of the work the court authorised the payment of $29,918 to a sub-contractor, securing the continuance of operations.

Continental.—RUSSIA.—The Soviet Government has recently placed a contract with the Siemens-Schuckertwerke Co., of Berlin, for two 44,000-kW turbo-generator sets for the Schterowka electric power station in the Donetz mining district.

SPAIN.—A recent return shows that Spain has now 101 hydro-electric companies, operating 118 installations. With average water supply which prevails during nine months of the year, they produce a total of 757,422 h.p., according to the estimate of the "Anuario Estadistico de Espana," or 1,300,000 h.p. according to the estimates of the industry. "The Boletin" of the Banca Arnus Gari of Barcelona places Spanish electrical production from all forms of power at 1,848,831,673 kWh for 1928, as compared with 1,707,730,514 kWh in 1927.

Dover.—LOAN.—The Town Council has applied for sanction to a loan of £2,000 for general mains.

Epsom.—YEAR'S WORKING.—The accounts of the Urban District Council's Electricity Department (engineer: Mr. H. W. Watts) for the twelve months ended March 31st last record an increase in total revenue from £24,257 to £27,998. Working expenses were £18,554, as compared with £18,387 in the preceding year, leaving a gross profit of £9,444 (£5,870), to which was added revenue from the sale of fittings and interest on investments, making a total of £9,476 available. After providing for capital and other charges, there was a net surplus of £774, as compared with a net deficiency of £830 in 1927-28. The sales of electricity increased from 1,710,592 to 2,338,190 kWh, and the maximum supply demanded from 1,000 to 1,341 kW.

Ealing.—ELECTRICITY SUPPLY.—A l.p. cable to distribute electricity to Islip's Manor and the Northolt Housing Estate is to be laid by the Uxbridge and District Electric Supply Co., Ltd. The estimated cost of the house services, to be paid by the Town Council, is £3 3s. 10d. per house, and tenders are to be obtained for wiring the houses.

Eston.—LOANS.—The Urban District Council Electricity Committee is applying for sanction to loans of £1,000 for rental wiring, £1,000 for services, £1,500 for meters, and £250 for domestic apparatus.

Exeter.—NEW PLANT INSTALLED.—A new 3,500-kW turbo-alternator was started up recently at the electricity works by Mrs. Arthur Brock, the deputy-Mayoress, vice-president of the East Devon Branch of the Electrical Association for Women, and wife of the chairman of the Electricity Committee.

Gravesend.—YEAR'S WORKING.—We have received from Mr. C. F. McInnes, borough electrical engineer, a copy of the accounts of the Corporation electricity undertaking for the year ended March 31st last. The total revenue amounted to £73,314, as compared with £70,024 in the preceding year, while the working expenditure dropped from £31,982 to £30,717. The gross profit was £42,597, as compared with £38,042 in 1927-28. Dividends on investments were added to the gross profit, making a total of £42,621 available. Of this £13,866 was absorbed by interest charges, and £11,523 by contribution to the sinking fund. The net profit, including £23 dividends on investments and subject to income tax, was £17,231, as compared with £15,384 in the preceding year. The capital expenditure during the year amounted to £38,367, the principal item being £24,316 for mains. The total now spent on the undertaking stands at £419,658. The electrical energy sold increased from 13,878,005 to 15,968,595 kWh, and the maximum supply demanded from 5,100 to 6,200 kW.

MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £1,500.

Greenock.—"GRID" SUPPLY.—The work in connection with the Central Electricity Board's scheme is now well advanced and preliminary testing has commenced. Preparations are now being made to make the 132,000-V transmission lines between Yoker and Greenock "alive." After the plant at the Dellingburn end has been tested the Greenock supply will be run in parallel with the Clyde Valley station at Yoker.

Guildford.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at Chilworth, at a cost of £1,000, and at Gomshall, at a cost of £492.

Japan.—HYDRO-ELECTRIC DEVELOPMENT.—The Hida Electric Light Company has obtained sanction to the erection of a hydro-electric power station in Gifu Prefecture.

London.—ISLINGTON.—The Borough Council Electricity Committee is to convert street lamps from gas to electricity in Copenhagen Street, Isledon Road and Tollington Road at a total cost of £1,720.

Lowestoft.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of the following amounts in connection with the provision of a supply of electricity to Kessingland:—£10,572 for mains and services and £3,410 for plant.

PEAK LOAD REDUCTION.—The Corporation Electricity Committee has decided that, in order that the payments to be made to the Great Yarmouth Corporation in respect of the bulk supply of electricity may not be unduly inflated by the operation of the peak load charge, the general manager shall circularise consumers suggesting that they should reduce the consumption of electricity to a minimum between the hours of 4.30 and 6 p.m. during the months of November and December. The committee has also decided to reduce the lighting of Normanston Drive by one-half until after 6 p.m. in the evenings during those months.

Manchester.—PROGRESS DURING SEPTEMBER.—During September the Corporation electricity undertaking showed an increase in connections of 2,038 kW, bringing the total up to 395,983 kW. The number of applications received for supply, including those for additional supplies, amounted to 1,304, representing a total of 2,876 kW. The number of hired cookers connected increased by 81, making the total number of cookers actually connected 5,605. Applications for the hire of cookers totalled 112. One new sub-station was put into commission, and additional plant installed at the Ancoats sub-station. The change-over from d.c. to a.c. had been completed in the cases of 8,502 consumers up to October 11th, and sanction had been given and work was in progress involving 1,178 consumers.

Middleton-St. George.—PUBLIC LIGHTING.—The Parish Council is to apply for sanction to borrow £700 for the provision of electric street lighting in the parish.

Newcastle.—TARIFF INQUIRY.—A Government inquiry into the charges for electricity in Newcastle is to be held on December 17th.

Portland.—SHOP-LIGHTING METERS.—The Urban District Council Electricity Committee has arranged that two-rate meters shall be installed for shop lighting, provided that a minimum of 120 watts be connected on the shop-lighting circuit.

Price Reduction.—TURTON.—The Urban District Council is to make the following reductions in the charges for electricity from January 1st next:—Lighting: From 6d. to 5½d. per kWh, with a minimum of £1 per annum. Heating, cooking, and domestic power: First 25 kWh per quarter, 2d. per kWh; over 25 kWh, 1d. per kWh. Power for industrial purposes: First 300 kWh per quarter, 3d. per kWh; next 200 kWh, 2d.; over 500 kWh, 1½d., with a minimum of £1 per annum.

St. Helens.—SPECIAL ORDER.—The Town Council has applied for a Special Order authorising it to supply electricity to the parish of Bold, and to a part of the township of Burtonwood.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Soham & District Gas Co., Ltd., to supply electricity in the parishes of Soham, Fordham, Burwell, Isleham and Wicken, in the rural district of Newmarket; and by the Exe Valley Electricity Co., Ltd., to extend its area of supply so as to include various parishes in the rural districts of Crediton, St. Thomas and Torrington.

The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Torquay Corporation to supply electricity in the urban district of Ashburnham and Buckfastleigh, and in parts of the rural districts of Newton Abbot and Totnes; the Holderness Trust, Ltd., to supply electricity in the urban district of Hornsea and in part of the rural district of Skirlaugh; James Lewis Hamilton Williams to supply electricity in the borough of the town and county of Haverfordwest; and the Pontardawe Rural District Council to supply electricity in part of the rural district of Pontardawe.

Stirlingshire.—ELECTRICITY SUPPLY.—A recommendation by the Housing Committee that the housing scheme at Bannockburn be wired for electric lighting and that no provision be made for gas lighting or cooking was approved by the Central District Committee of the County Council at a recent meeting.

Wakefield.—UNDERTAKING PURCHASE OFFER REJECTED.—The Town Council has rejected the offer of the Yorkshire Electric Power Co. to purchase the Corporation electricity undertaking for £250,000 plus a further substantial sum.

Walsall.—MAINS EXTENSIONS.—The Corporation Electric Supply Committee has received authority to extend mains at a cost of £3,150 to supply houses on the Wolverhampton Road.

Warwickshire. — SANATORIUM ELECTRICITY SUPPLY. — The County Hospitals Committee reports that owing to the many extensions to the sanatorium and the large number of attendances in the artificial light department, it has been found necessary to consider amplifying the electrical and heating services. It is therefore obtaining the advice of an independent consulting engineer to report on the minimum, immediate and permanent work necessary to provide efficient electrical and heating services, but adaptable for further extension if necessary.

Whitehaven.—SPECIAL ORDER.—The Town Council has decided to apply for a Special Order to supply electricity to Preston Quarter, Sandwith, and Hensingham.

Winchester.—ELECTRICITY SUPPLY.—The City Council has received sanction to a loan of £8,567, part of the cost of supplying electricity to the parishes of Twyford and Compton.

Worthing.—RESTRICTED SUPPLY.—The borough electrical engineer has called the attention of the Town Council to the fact that, owing to the delay in receiving the additional power to be furnished by the Central Electricity Board from Southwick, the generating plant at the Corporation's power station is inadequate fully to satisfy consumers' normal requirements until the external service is available. He suggests that a circular letter should be sent to all consumers requesting them to reduce their demands between the hours of 4 p.m. and 8 p.m., except on Sundays, as follows:—(*a*) Indoor lighting installations: Use one lamp less than usual where more than one is ordinarily in service at one time. (*b*) In mixed heating and lighting installations: Use one lamp less than usual as in (*a*) and one radiator bar less; or one complete radiator less where more than one is ordinarily used at one time. (*c*) Shop windows and display installations: Reduce by one-half. (*d*) Electric motors, &c.: Reduce the use of motors and other special apparatus. Also he proposes that consumers should be further requested not to add to their installations until notice has been received that normal use may be resumed. The Town Council has adopted the suggestions, and the Highways Committee has also been asked to reduce the street lighting as much as possible. The town clerk has further been requested to communicate with the Central Electricity Board protesting against the delay, and urging it to complete the laying of the transmission lines and to commence the supply promised as soon as possible.

Tramway and Railway Notes.

Australia.—MELBOURNE.—The Victoria State Ministry is to introduce a Bill authorising the Melbourne and Metropolitan Tramways Board to borrow £750,000 for the purpose of converting cable tramways to electric traction. Details are being prepared with regard to the cost, &c., of the conversion of the Brunswick Street (North Fitzroy), South Melbourne and Port Melbourne lines. It is stated that no further conversions can be undertaken till the end of the current year, and till the Collins Street line is completed. The amount to be provided for by the Bill may not be sufficient to carry out all these conversions, and adjustments may have to be made. The Tramways Board some time ago indicated to the Fitzroy Council that the conversion of the Brunswick Street line would follow immediately on the conversion of the Collins Street line. It is stated by the *Melbourne Argus* that the Port Melbourne line may be abandoned, and a 'bus service instituted round Fisherman's Bend.

Plans for the control of the metropolitan tramways are being discussed by the State Cabinet. The term of appointment of the Board will expire at the end of the year, and the Ministry desires to arrange for the creation of a reconstituted authority to control the tramways. The lack of reasonable tenure is said by members of the Board to prevent any continuity of policy, thus hampering effective administration.

Continental.—DENMARK.—The long-projected electrification of the private railway between Copenhagen and Slargerup is now to be carried into effect. The directors are negotiating with the A.E.G. and the Swedish A.S.E.A. on the basis of the estimates submitted by them some time ago.

NORWAY.—Of the 2,480 miles of railways in Norway approximately 100 miles had been electrified up to the end of last year. The electrification of the line from Drammen to Kongsberg is, however, nearing completion and is expected to be open to traffic shortly. When the Drammen bridge is completed it will be possible to run electric locomotives from Oslo to Kongsberg. Preliminary work on the electrification of the line from Kongsberg to Notodden, Skien, and Brevik has been started. The work of electrifying the Hoved railway has been completed from Oslo to Lillestrom and work on the remaining section is under way.

SWITZERLAND.—At the next meeting of the Conseil d'Administration of the Swiss Federal Railways the programme will be laid before the Board as to the next stage in the electrification of the railways for the coming seven years. The length of line affected is estimated at 476 km., and the proposed budget amounts to 81 million fr. Out of this sum three millions will be needed for the strengthening of bridges and viaducts, and 34,000 fr. for the purchase of tractors.

Hastings.—RAILLESS CARS.—The Hastings and District Electric Tramways Co., Ltd., is introducing a Bill in Parliament applying for powers to run railless cars on new routes in the town, and also to Battle.

Leyton.—THE L.C.C. TRAMWAY AGREEMENT.—At a meeting of the Urban District Council held recently it was stated that, unless Leyton provided fifty new trams, the London County Council was not prepared to consider the renewal of the agreement under which the tramway undertaking is operated by the L.C.C. It was decided that the question of purchasing fifty new cars at a cost of £150,000 should be postponed for one month.

London.—RAILLESS CARS.—A Bill is to be promoted in Parliament to enable the London United Tramways Co., Ltd., to substitute railless cars for trams on existing routes. Should Parliamentary sanction be given, experimental services will be run on the company's routes between Tolworth, Surbiton, the Dittons, Teddington, Twickenham, and Kingston, and between Kingston and Richmond Park gates on Kingston Hill.

Newport (Mon.).—RAILLESS CARS.—The Town Council has decided to replace some of the tramways by railless cars, and also to seek powers to run these vehicles outside the borough.

Northern Ireland.—BELFAST.—The City Council is to consider the question of purchasing an additional fifty tramcars.

The Southern Railway.—EXTENSION SCHEMES.—Among improvements and extensions for which the Southern Railway Company is to seek Parliamentary powers is the construction of a new railway, described as the Motspur Park and Leatherhead Railway, linking up the Wimbledon and Epsom line south of the Blue House level crossing with the Epsom and Leatherhead line north-east of the railway bridge carrying the Kingston road.

Telegraph and Telephone Notes.

Irish Free State. — WIRELESS-TELEPHONY.—Wireless-telephone apparatus, which will keep the islanders off the coasts of West Galway and Mayo in constant touch with the mainland, has been installed by the Irish Post Office at Clifden, Bofin, and Clare Island. The apparatus has been tested by Post Office officials, and communication will now be possible in any weather.

Switzerland.—NEW RADIO STATION.—The country entered into the possession of another wireless station on November 7th. Mr. Haab, president of the Confederation and a delegate for Switzerland to the League of Nations, opened the new and important plant at Prangins, near Nyon, on Lake Léman.

The Telephone Service.—RECORD YEAR IN PROSPECT.—Comparative figures of world telephone development for eight years since 1920 show that of the seven countries with the greatest telephone density, Australia alone shows a greater percentage increase than Great Britain during that period. Since 1920 telephones in Australia have increased by 111 per cent.; in Great Britain by 78 per cent.; in Germany by 63 per cent.; in Canada by 57 per cent.; in the United States by 42 per cent., in Denmark by 30 per cent., and in Sweden by 22 per cent. "It may perhaps be urged," says the *Telegraph and Telephone Journal*, "that it is easier to show a high percentage development on one million than on thirteen million telephones, and that the countries with low telephone densities should exhibit a more rapid growth. This, however, is not altogether the case, for telephone history shows that at that period when countries begin to reach a high density the development curve begins to soar upwards. In other words, when the telephone habit is already firmly established, the demand for the telephone by those who have it not becomes the more insistent." Regarded from this point of view, it is noteworthy that Britain's telephone increase grows yearly greater; in 1927 it was 121,000; in 1928 it was 125,000; and in 1929 it should be between 128,000 and 129,000. There is thus reason for hope that England is now beginning to make up some of her very considerable leeway in telephony affairs.

NEW INSTRUMENTS.—The House of Commons was informed by Mr. Viant, Assistant Postmaster-General, that a new hand combination telephone instrument was being introduced as an alternative to the present "candlestick" pattern, and supplies were expected about the end of the year. The new pattern would be more costly to provide and maintain than the old instrument, and subscribers who desired to have it installed would, accordingly, be asked to pay an additional charge of 4s. a quarter.

NEW WORK.—Mr. Lees-Smith, Postmaster-General, recently informed the House of Commons that the new constructional work contemplated, which was to cost £750,000, was in addition to the authorised programme for the year, which would cost £10,500,000. The additional work would be put in hand forthwith.

Radio Notes.

Canada.—RELAYS—A programme of 25 national broadcasts, to be given this winter over its new Atlantic-to-Pacific wireless "chain," has been arranged by the Canadian National Railways. It will involve the use of 16 stations, stretching from Halifax, N.S., to Vancouver, and approximately 15,000 miles of land wire. Some conception of the engineering difficulties involved is indicated by the fact that five different time zones are covered, each representing a difference of one hour.

France.—RADIO CONFERENCE.—The National Wireless Conference concluded its labours last week. Among the papers read on the last day were some concerning broadcasting and popular education, broadcasting and moral influence, authors' rights, broadcasting and the Press, and wireless programmes. No decisions were come to by the Conference with regard to the Wireless Statute, which will eventually legally determine the status of this new factor in the nation's life.—*Reuter's* (Paris).

Germany.—FINANCE.—The Reich Commissioner for Broadcasting announces that receipts during 1928 amounted to £1,600,000, almost entirely derived from fees. Expenditure totalled £1,440,000, the cost of programmes (including the sums paid to performers, orchestras, and theatres) being £610,000. Electric power cost £240,000. A dividend of 7½ per cent. has been distributed and £55,000 carried forward. Of the share capital, 25½ per cent. is in private hands and the balance held by the Reich Postal Ministry, the State Governments, Municipalities, and public bodies.

Italy.—NEW STATION.—The first Italian high-power station, which will have cost £200,000 to equip and will be one of the most powerful in Europe, will be opened on November 28th. It is situated at Santa Polomba, 15 miles from Rome, on the Roman Campagna.

U.S.A.—RADIO-FREQUENCY PATENT.—The Radio Corporation of America has been informed that a decision has been handed down by the Privy Council, the highest appellate tribunal in the British Empire, upholding the Alexanderson tuned radio-frequency patent against the Schloemilch and von Bronk patent. The case went to the Privy Council in London on appeal from the decision of the Supreme Court in Canada. The *T. & T. Age* explains that in the Canadian litigation, the Alexanderson patent was sustained by the lower court, which decision was reversed by the Supreme Court of Canada, after which jurisdiction of the controversy was taken by the Privy Council. The two patents had already been considered by two Federal District Courts of the United States, both of which had decided in favour of the Alexanderson patent.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Sydney.—December 16th. Public Works Department. Electrically-driven pumping set for the Junce water supply. (A.X. 8740.)*

Edinburgh.—December 2nd. Education Authority. Electric lighting and heating installation, in connection with extensions at Lochend Road school. Specifications, &c., from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—Cairo.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

Hull.—December 19th. Electricity Department. Supply of electricity meters. (See this issue.)

London.—Stepney.—December 5th. Board of Guardians. Installation of wireless receiving apparatus at each of its three hospitals. The apparatus required will include 1,159 headphones and 24 loud-speakers. (November 15th.)

Commissioners of H.M. Works, &c.—November 28th. H.p. and l.p. switchgear, transformer and cables for H.M. Office of Works generating station, South Kensington. (November 15th.)

Central Electricity Board.—December 21st. Supply, delivery, and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (See this issue.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

Christchurch.—December 13th. Christchurch Drainage Board. Four electrically-driven pumping plants and two horizontal type 3 h.p. a.c. motors, direct coupled with centrifugal sewage pumps. (A.X. 8788.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW, oil-immersed, circuit breakers for Arapuni. (B.X. 5878.)*

Salford.—November 25th. Corporation. Electric travelling and slewing jib crane. (November 8th.)

South Africa.—Bloemfontein.—December 2nd. Waterworks Department. Two low-lift and two high-lift electrically-driven pumping units, with cables, starters, &c. (A.X. 8710.)

December 2nd. Municipal Council. Copper conductors, poles, transformers, and switchgear. (B.X. 5825.)*

Pretoria.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

Catooma, Rhodesia.—December 12th. Municipal Council. Two boilers, steam engines, alternators and switchboard. (A.X. 8749.)*

Spain.—Madrid.—Tenders will shortly be invited for the supply of a 10-ton electric crane for the port of Marin (Pontevedra) and of four electric cranes for the port of Vigo.—*Reuter's Trade Service* (Madrid).

Stockport. — December 2nd. Electricity Department. Supply, delivery and erection of 6,600-V switchgear. (November 8th.)

Stone.—November 25th. Electricity Department. E.h.p. overhead 11,000-V transmission line (2,300 yd.); two 50-kVA sub-stations, and l.p. overhead distribution services (1,400 yd.), &c. (November 8th.)

West Ham.—November 28th. Union Guardians. Installation of fire-alarm system, Whipps Cross Hospital, Leytonstone. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Coventry.—Board of Guardians.
Electric lighting and bell installation at Exhall Hospital (£177).—Burbury, Laird & Co.

Glasgow.—Lighting Committee. Accepted:—
20,000 yd. 7/.036-in. cable, Metropolitan Electric Cable and Construction Co., Ltd.; 6,000 yd. 7/.064-in. ditto, British Electrical & Manufacturing Co., Ltd.
300 37-ft. 6-in. steel poles, 200 28-ft. steel poles.—Stewarts and Lloyds, Ltd.
Street lanterns.— General Electric Co., Ltd.

Hampton.—Urban District Council. Accepted:—
Overhead cable to sewage works; wiring, fittings, &c. (£127).—Twickenham & Teddington Electricity Supply Co., Ltd.

Limerick.—Committee of Management, Limerick Mental Hospital.
Wiring the Institution (£1,750).—Fitzgerald & Co. (Accepted.)

Liverpool.—Mersey Docks and Harbour Board. Accepted: Electric cables, &c.—British Insulated Cables, Ltd.

London.—London County Council.—Highways Committee. Accepted:—
Electric lift for boiler house at Greenwich power station (£696).—Express Lift Co., Ltd.
Machined bronze bearings (£4,177).—Anti-Attrition Metal Co., Ltd.
3,000 driving wheel tires and 3,000 pony wheel tires.—Hadfields, Ltd.
700 tons of rolled mild steel bar.—Cargo Fleet Iron Co., Ltd.
100 commutators.—Dyer & Young, Ltd.
24,000 tie bars.—Bayliss, Jones & Bayliss, Ltd.

Switchgear for Greenwich, Limehouse, Tooting, and New Cross tramway sub-stations:—

Switchgear & Cowans, Ltd. (Accepted.)	£10,492
A. Reyrolle & Co., Ltd.	11,908*
Bertram Thomas	11,973
Park Royal Engineering Co., Ltd.	12,187*
English Electric Co., Ltd.	12,218
General Electric Co., Ltd.	12,267
Metropolitan-Vickers Electrical Co., Ltd. ...	12,267
Ferguson, Pailin, Ltd.	12,305
British Thomson-Houston Co., Ltd.	12,595*
Johnson & Phillips, Ltd.	12,659
New Switchgear Construction Co., Ltd. ...	23,910

* Tender subsequently withdrawn.

Metropolitan Water Board.
Boiler plant for Deptford pumping station (£26,945).—John Thompson Water-Tube Boilers, Ltd. (Recommended.)
Two electric pumps for Kempton Park works (£174).—Salaman Hardoll, Ltd. (Accepted.)

Islington.—Electricity Committee. Recommended:—
Installation work in connection with wiring schemes. Extension of contract for 12 months.—E. H. Finn.

Great Western Railway Co.
Part contract for the supply of gasfilled, vacuum ordinary and train lighting lamps.—Metro-Vick Supplies.

Hammersmith.—Electricity Committee. Accepted:—
Four 1,000-kVA transformers (£1,590).—British Electric Transformer Co., Ltd.
H.p. switchgear (£641).—A. Reyrolle & Co., Ltd.

Stoke Newington. — Electricity Committee. Recommended:—
Prepayment-type meters for 12 months.—Measurement, Ltd.
Installation work under assisted wiring schemes for 12 months.—A. R. Carnidge & Co. for 4- to 6-point installations wired in lead-covered cable system (18s. 3d. per point).
Section pillars (£325).—Lucy & Co.

Newport.—Great Western Railway Co. Accepted:—
Transformers for nine 3-ton cranes at South Quay, South Dock.—Crompton Parkinson, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Reconstructing the cliff lift (£3,075).—Waygood-Otis, Ltd.

Forthcoming Events.

Physical Society.—Friday, November 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, November 22nd. Grand Hotel, 7 p.m. "Dust Explosions." Mr. J. D. Morgan.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 23rd. Royal Star Hotel, Maidstone, 6 p.m. Annual dinner.

(London Technical Group).—Tuesday, November 26th. Junior Institution of Engineers, 39, Victoria Street, S.W., 7.15 p.m. "Protective Apparatus." Mr. R. O. Kapp.

(London Central Section).—Friday, November 29th. Slater's Restaurant, High Holborn, W.C. Annual dinner.

(Derby Section).—Saturday, November 23rd. Black Boy Hotel, Nottingham, 6.45 p.m. Annual dinner.

(Manchester Section).—Thursday, November 28th. Geographical Hall, Manchester, 7 p.m. Address by the President, Mr. T. D. Martin.

Liverpool Industrial Section.—Saturday, November 23rd. Bear's Paw Café, Liverpool. Annual dinner.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 25th. Institution, London, W.C., 7 p.m. Discussion on "Wooden Poles for Overhead Transmission Lines and their Preservation," to be opened by Mr. C. Wade.

Thursday, November 28th. Institution, London, W.C., 6 p.m. "Voltage Control of Large Alternators." Mr. H. W. Taylor.

(North-Eastern Centre).—Tuesday, November 26th. Armstrong College, Newcastle-on-Tyne, 7 p.m. Faraday Lecture, "Broadcasting by Electric Waves." Captain P. P. Eckersley.

(North-Midland Centre).—Tuesday, November 26th. Hotel Metropole, Leeds. 7 p.m. "Surges and Overvoltage Phenomena on Transmission Lines due to Lightning and Switching Disturbances." Dr. H. Norinder.

(North-Western Centre).—Tuesday, November 26th. Engineers' Club, Manchester, 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lieut.-Col. S. E. Monkhouse and Mr. L. C. Grant. (Joint meeting with the Manchester Association of Engineers.)

(Scottish Centre).—Tuesday, November 28th. Grosvenor Restaurant, Glasgow, 6.30 p.m. Annual dinner and dance.

(South-Midland Centre).—Friday, November 29th. Grand Hotel, Birmingham, 7 p.m. Annual dinner.

(East-Midland Sub-Centre).—Tuesday, November 26th. The University, Nottingham, 6.40 p.m. "Low Temperature Carbonisation of Fuel, with special reference to its Combination with the Production of Electricity." Mr. E. H. Smythe and Mr. E. G. Weeks.

(North-Eastern Students' Section).—Friday, November 22nd. Grand Assembly Rooms, Barras Bridge. Annual dance.

Mersey & North Wales (Liverpool) Centre.—Wednesday, November 27th. University Club, Liverpool. Annual dinner.

Institute of Marine Engineers.—Tuesday, November 26th. The Institute, The Minories, E., 6.30 p.m. "The Origin and Development of Heavy Oil Engines." Mr. A. F. Evans.

Friday, November 29th. Hotel Victoria, 7 p.m. Annual conversazione.

Electrical Trades Benevolent Institution.—Tuesday, November 26th. Savoy Hotel, W.C. Annual dinner and dance.

Institute of Physics.—Wednesday, November 27th. Institution of Electrical Engineers, Savoy Place, W.C., 5.30 p.m. "Physics in Relation to the Utilisation of Fuel." Dr. C. H. Lander.

Royal Society of Arts.—Wednesday, November 27th. John Street, Adelphi, W.C.2, 8 p.m. "The Examination of Coal and Coke by X-rays." Mr. C. N. Kemp.

Institution of Mechanical Engineers.—Friday, November 29th. Institution, Storey's Gate, S.W., 6 p.m. Debate on "The Registration of Reliable Tests of Power Plant Machinery," to be introduced by Mr. R. H. Parsons.

Junior Institution of Engineers.—Friday, November 29th. 39, Victoria Street, S.W., 7.30 p.m. "Modern Welding Systems and Applications." Mr. W. C. Freeman.

Mishap at Nechells.

According to *The Times*, an explosion, followed by a fire, occurred shortly after midnight on Tuesday at the Prince's power station at Nechells, one of the principal generating stations under the control of the Birmingham Corporation, and for a time the supply of electricity was interrupted over a wide area.

Notes.

Inquiry at Barnes.

An inquiry was held on November 13th and 14th, at the Barnes Council Offices, by Col. T. C. Ekin, inspector of the Electricity Commissioners, into the application of the Barnes Urban District Council for consent to extend its generating station. The application was opposed by the London and Home Counties Joint Electricity Authority. Presenting the case for the Council, Mr. F. J. Wrottesley stated that the electricity undertaking, which came into existence in 1902, had progressed so satisfactorily that to-day it was able to show the sale of 10¼ million kWh per annum. Giving evidence, Mr. C. S. Davidson, the Barnes electrical engineer, produced a table of returns for several years. On being cross-examined by Sir Lynden Macassey, the representative of the London Joint Authority, Mr. Davidson at length admitted certain inaccuracies in the figures as submitted to the Electricity Commissioners. Referring to these figures, Sir Lynden Macassey compared them with a table of revised figures which had been prepared, and showed various discrepancies in the distribution costs and in the estimated consumption. Sir L. Macassey, outlining the London Joint Authority's opposition, said that they had been described by Mr. Wrottesley as "middle-men," but that it was a little late in the day to adopt a position of that sort, since everything proposed by his clients was in harmony with the Act of 1926. Also, as the Joint Authority, they were able to supply electricity on much more favourable terms than Barnes could generate it. Mr. F. W. Purse, chief engineer of the London and Home Counties Joint Electricity Authority, stated that the figures of Mr. Davidson were rather optimistic, but even so his Authority had made an offer, and would stand by it. Mr. Purse added most emphatically that the proposed arrangement with Barnes would show no profit to the Joint Authority, and that any loss incurred would be borne by the Central Electricity Board.

The Commissioners will give their decision in due course.

Fatality.

An inquest was held at Stafford on November 4th on John Ecclestone (57), who received a fatal electric shock on the premises of the English Electric Co., Ltd., on October 31st. Frederick Emberton, a tester for the company, said that Eccleston was assisting him to connect up a 2,500-h.p. motor. He was instructed to change a transformer and connect a phase advancer which were "dead," but he was not told to put the cable on the busbars. Alex John Dan, a tester, said that the temperature of his machines was constant and he shut them down. Having taken the temperature he ran one of the machines up again. He got up to about 2,400 V when he heard several people shout and he immediately had the supply cut off again.

It was suggested that deceased connected one of the cables to the bars under the impression that Dan had finished. A verdict of "accidental death" was returned.

Electricity in Mines.

The report for 1928 of Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, contains much of interest to all electricians, managers, and others concerned with electrical equipment in mines. Progress in electrical development at mines under the Coal Mines Act is analysed in detail. The total horse power of motors installed was 1,722,332, or 38,000 h.p. greater than in 1927. Electricity was used at 1,467 mines. The statistical tables include a regional analysis of the h.p. of motors installed, showing the comparative use of direct current and alternating current, and analyses (with comparative figures for 10 years) of fatal accidents classified according to the type of accident, the employment of the persons killed, and the nature of the equipment involved. The inspector describes the 15 fatal accidents attributable, either directly or indirectly, to the use of electricity which occurred during the year, and makes suggestions with a view to preventing accidents of a similar nature in future. He also gives particulars of three dangerous occurrences of an unusual nature, and describes 21 recent electrical accidents involving trailing cables and plugs. The inspector classifies the latter, and discusses the design of plugs and trailing cables. With regard to coal-cutting machines, general analyses of the number and description of machines in use at coal mines during the last ten years are given, together with regional analyses of the quantities of machine-cut coal and other mineral got by electricity and by compressed air; 25.2 per cent. of all coal mined during 1928 was machine-cut, and 65.9 per cent. of machine-cut coal was got by means of electric coal cutters. The inspector draws attention to the interest which is being shown in the application of automatic starters (remote control to coal-cutting machines, and to the practicability of the standardisation of trailing cables, which is now being investigated by the British Engineering Standards Association. Copies of the report (price 6d., by post 7d.) can be obtained from H.M. Stationery Office.

Express Locomotives on the Paris-Lyons and Mediterranean Railway.

The P.L.M. Railway Co. has recently put into service, on the Mt. Cenis line, four electric locomotives which are said to be the most powerful single-unit locomotives built so

far. The locomotives, which have a one-hour rating of 5,400 h.p. at the wheel rim, are capable of developing a maximum speed of 80.7 m.p.h.; they are operated with direct current at 1,500 volts.

The locomotives are equipped with six driving motors, each built as twin motors, and arranged for forced ventilation. Current is collected from the overhead lines by means of two pantographs, and from a third rail by means of four contact shoes on either side of the locomotive. All the switchgear for grouping the motors, for cutting in and out the starting resistances, and for reducing the field, as well as the main circuit-breakers in the motor circuits, are built in the form of electro-pneumatically operated contactors. There are 58 contactors in all, some operated by master controllers in the drivers' cabs and others by inter-dependent interlocking contacts.

In the event of a breakdown of any essential part, such as contactor, reverser, or starting resistances, the locomotive can still run with one-half of the equipment. Detailed descriptions of these locomotives, and of the 1,440 h.p. motor coaches supplied for the Berne-Neuchatel Railway in Switzerland, are given in Bulletin No. 101 of Messrs. Oerlikon, Ltd.

Supply Developments at Barrow.

On November 15th the Mayoress of Barrow-in-Furness, Miss M. Whinnerah, officially inaugurated extensions to the plant at the Corporation electricity works in Buccleuch Street, and also new showrooms and offices in Cavendish Street. The plant extensions include a 7,000-kW turbo-alternator, a 60,000-lb. boiler, new switchgear and various auxiliaries. The work has been carried out to the specification of Mr. H. R. Burnett, borough electrical engineer, assisted by the constructional engineer, Mr. W. Fisher. In order to accommodate the turbo-alternator in the existing building it was necessary to remove four reciprocating sets of a total capacity of 800 kW. The new set, which was supplied by the Metropolitan-Vickers Electrical Co., Ltd., as sub-contractors to Messrs. Vickers-Armstrong, Ltd., is of the two-cylinder impulse type, and provision has been made for bleeding the turbine at two stages for the purpose of feed-water heating to a temperature of 225 deg. F. The condensing plant was manufactured by Messrs. Vickers-Armstrong, and is of the contraflo kinetic type, having a cooling surface of 8,500 sq. ft.; it is capable of condensing 80,000 lb. of steam per hour. The circulating water and extraction pumps are duplicated, and are driven by squirrel-cage induction motors, which can be supplied either from the station bus-bars or from the transformer connected to the alternator terminals. Two ejector air pumps of Messrs. Vickers-Armstrong's manufacture have also been installed, and, in addition to the electrically-driven feed pumps, there is one steam turbine centrifugal feed pump of Messrs. G. & J. Weir's manufacture. The whole of the e.h.p. and l.p. switchgear and power transformers were also supplied by the Metropolitan-Vickers Electrical Co., Ltd., together with Merz-Price protective gear and a Metropolitan-Vickers automatic voltage regulator. A 25-ton electric overhead travelling crane in the engine room has been supplied by the Wharton Crane and Hoist Co., Ltd.

In order to provide accommodation for the new boiler, two of the old boilers had to be removed. The new boiler was supplied by the Stirling Boiler Co., Ltd., and the steam conditions are 200 lb. per sq. in. and 700 deg. F. The boiler is fitted with Underfeed stokers of the "L" type and "Karrena" flat arches. The economiser is of Messrs. Green's tri-tube type. A Howden-Ljungström rotary-type air heater with a heating surface of 8,000 sq. ft. has also been installed. Forced- and induced-draught fans were supplied by Messrs. Davidson and Co., Ltd., who also supplied the flue-dust collector. New coal-handling plant capable of dealing with 25 tons of coal per hour has been installed by Messrs. Naylor Bros., Ltd.

After the opening of the plant a celebration luncheon was served at the Barrow Town Hall, under the chairmanship of Alderman T. Morton, chairman of the Electricity Committee. Alderman Basterfield, J.P., gave the toast of "The Electricity Undertaking." He said the Corporation undertaking had undoubtedly been a success, and he spoke of that success not so much from the financial point of view as from the utilitarian point of view, and the people who were concerned with it deserved encouragement.

Alderman Morton, in reply, outlined the progress made by the electricity undertaking. There were 7,000 consumers connected with the undertaking, and the town clerk had modelled a hire-purchase agreement for the wiring of houses. In opening the new showroom, he was convinced that the Committee was doing the right thing.

The Mayor of Barrow, in proposing "The Contractors," referred to the giving of the contract for the turbo-alternator to the local firm of Messrs. Vickers-Armstrongs, Ltd., instead of to a Swiss firm whose price was £9,000 lower. The £9,000 supposed to be lost was more than saved by having the work done by the local firm.

Mr. J. S. Peck, representing the Metropolitan-Vickers Electrical Co., Ltd., replied for the contractors, and presented the Mayoress with a silver coffee set as a memento of the occasion. The company next went to the new showrooms and offices, where the Mayoress received a souvenir in the shape of an antique bronze table lamp, with hand panels. The new showroom premises were originally built as an ironmonger's stores. The building is a three-storey one occupying a ground space of 84 ft. by 68 ft. Extensive alterations and improvements have been carried out upon the interior of the building, in which the following accommodation has been provided: ground floor; showroom, consumers' engineer's office, and workshop. First floor; offices, lounge, and demonstration, dining, bath and bedrooms. Second floor; offices and demonstration and lecture rooms. The work was carried out under the supervision and to the specification of Mr. W. C. Persey, borough surveyor, and Mr. J. A. Charles, in collaboration with the borough electrical engineer and his staff.

The Padiham Power Station.

With a fuel consumption of 1.33 lb. of coal per unit generated and a thermal efficiency of 21.35 per cent., the Padiham power station of the Lancashire Electric Power Co. takes premier place in the Electricity Commissioners' report for the year ending 31st March, 1929. This achievement is the more remarkable as Padiham comes in the "50-100 million units generated" group of power stations, there being two groups with higher outputs, namely "100-200 million" and "over 200 million" units. Thus, Padiham ranks as the most efficient power station in Great Britain, irrespective of size and output. It is interesting to record the following figures for Padiham for the year ended March 31st, 1929, which are:—

Total number of units generated at Padiham during the year	67,043,877
Units generated by latest 15,625-kW turbo-alternator	59,925,000
(Practically 90 per cent. of the total output of the station.)	
Number of running hours during the year ...	6,057
Average load on the machine	9,893 kW.

These figures are a tribute to Mr. M. H. Adams, the resident engineer of the Lancashire Electric Power Company, his staff and the manufacturers of the plant. Although it is too early to predict the results which will be obtained at the L.E.P. Company's new super station at Kearsley, the load on the first 32,000-kW turbo-alternator having, hitherto, not exceeded 20,000 kW, the evidence is such as to justify expectations of still better results. It may be added that, in addition to the turbo-alternators, all the electrical equipment at both the Padiham and Kearsley power stations was supplied by the British Thomson-Houston Co., Ltd.

The Automobile Electrical Association.

As was briefly mentioned in our issue of November 8th, the leading firms which specialise in servicing motor-vehicle electrical equipment have just formed a new society, with the title of the "Automobile Electrical Association" to look after their special interests. Mr. E. C. Ford has been elected chairman of the provisional committee, which consists of: Messrs. A. W. Bridges, Newcastle-on-Tyne; J. J. Davis (Express Magneto (Repairs) Electrical Co., Ltd.), Yeovil; E. C. Ford (Autocar Electrical Equipment Co., Ltd.), London; J. E. Hardy, Glasgow; F. H. Jennings, Dudley; A. E. Ponton (A. E. Ponton and Sons), Bournemouth; J. E. Reilly (Reilly & Brookes), Bolton; J. Robertson (John Robertson (Belfast), Ltd.), Belfast; J. Shaw (Magneto Repairs (Leeds), Ltd.), Leeds; and E. S. R. Thorne (Thorne Bros.), Worthing. Mr. H. Scott Hall, M.I.A.E., the secretary, whose offices are at 2, Tichborne Court, High Holborn, W.C.1, has indicated that the general opinion is that membership should be confined to firms "whose business is mainly that of servicing the electrical equipment of automobiles and other electrical services, and who are not engaged in the repair of engines, chassis, or coachwork." This ruling will, as may be gathered, exclude from membership all motor garage firms, but we understand that firms specialising in the repair of dynamos and motors for lighting and power purposes are eligible.

Industrial Welfare Society.

The annual meeting of the Society was held on November 14th. The Duke of York, who presided, said that any scheme of welfare work, to be effective, must depend upon the personal enthusiasm of the head of a firm. The society was giving real service, and he could think of no movement which was doing more to promote the general well-being of industry.

Appointments Vacant.

Showroom salesman for Barrow-in-Furness Corporation. Test room supervisor and test room assistant for Hull Corporation. Plumber-jointer for Bingley Urban District Council. Assistant engineers for the Test Room and Installation Department and the Meter and Consumers' Installation Department of Sunderland Corporation. Chief station mechanic for the Government of Grenada. Plumber-jointer for the Borough of Hampstead Electricity Supply Department. (See our advertisement pages to-day.)

B.S.S. for Colliery Requisites.

In continuance of the programme of work in its colliery section, the British Engineering Standards Association has just issued specifications for underground lighting fittings and for flattened strand winding and haulage wire ropes. The underground lighting fittings specification, No. 238-1929, provides for fittings for use with British standard vacuum tungsten-filament lamps, with a minimum rating of 60 watts, and its main purpose is to ensure interchangeability of such

parts, as well as glasses that require frequent replacement. The provisions in regard to interchangeability are also extended to cover the attachment of the cables, so that with the new standard fittings quick replacement of damaged fittings will be facilitated. The flattened strand rope specifications contain clauses regulating the testing carried out in connection with the purchase of colliery haulage and winding ropes, tensile and torsion tests of the wire being specified both before and after the manufacture of the rope.

Copies of these specifications can be obtained from the British Engineering Standards Association Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

The Association of Consulting Engineers.

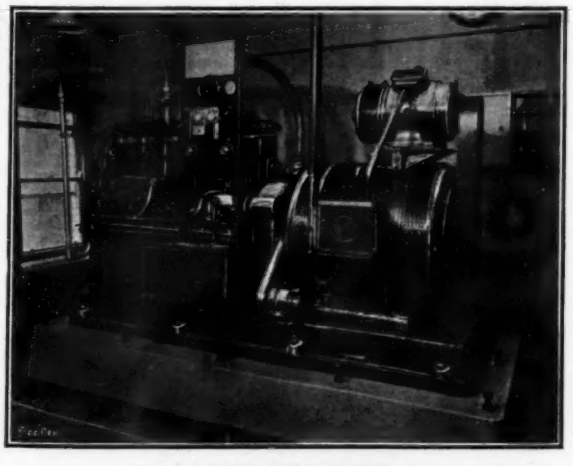
The annual dinner of the Association of Consulting Engineers (Incorporated) was held on November 13th at St. Stephen's Club, S.W. The chairman of the committee, Mr. N. G. Geyde, O.B.E., M.Inst.C.E., presided over a gathering of about 160 members and guests. Mr. S. C. Lewis, M.Inst.C.E. (hon. treas.), in proposing the toast of the High Court of Parliament, hoped that body would resume control of legislation, to which the Rt. Hon. Lord Darling, P.C., replied that whatever changes had been made in the past, Parliament had gone on much the same and he supposed would continue to go on.

Sir Thomas Robinson, C.B.E., M.P., also responded. He expressed the view that economic precedes political power. Brains still provided the driving force of the country. Round table conferences between masters and men were wanted to discuss why we could not sell the goods. The health of the guests was proposed by Mr. G. M. C. Taylor, M.C., M.Inst.C.E. Mr. Taylor named three obstructions to engineering progress: legal, financial, and sentimental, including under the latter heading most of the objections to the erection of pylons.

Response was made by the Rt. Hon. Sir John Anderson, P.C., G.C.B. (permanent under-secretary, Home Office) and by Dr. S. Z. de Ferranti, F.R.S. Sir John read an extract from the new edition of the Encyclopædia Britannica, which sets out a list of virtues which should belong to the engineer (professional). He defended the Civil Service from the charges often levelled against the bureaucracy. Dr. de Ferranti recalled how, starting as a consultant, he had been compelled to become a manufacturer owing to absence of suitable plant in those days to meet electricity supply problems. Mr. L. St. L. Pendred (vice-president of the Institution of Mechanical Engineers) in a racy speech proposed the toast of "The Association of Consulting Engineers," to which the chairman responded, giving a summary of the origin and aims of the Association.

Silent Generating Plant.

Interesting generating plant has recently been installed in the power house of the Western Union Telegraph Co. at Penzance. Being situated in the centre of a residential area, no vibration or noise of any description was permitted; a petrol engine was accordingly selected and, to make assurance doubly sure, the whole plant was mounted on special shock absorbers, which can be seen in the accompanying picture under the first concrete bed, the shock absorbers being, of course, bolted to a further concrete bed below. The engine was made by the Parsons Oil Engine Co., Ltd., and is of the standard 6-cylinder type having a bore of 4½ in. and stroke of 6 in., mounted on a heavy cast-iron bedplate and directly coupled to a special 30-kVA, 25-cycle alternator. It is fitted with electric starting equipment, including batteries and charging dynamo, and, in addition to the standard engine governor, an automatic over-speed cut-out is incorporated. The whole of the controls, including a thermometer, pressure gauge, tachometer, electric starter switch, cut-out, throttle, and ignition controls, are brought to a panel situated on the side of the plant. This was necessary in order to reduce the length of the plant to a minimum, for which reason also the exciter is driven by means of a chain and is situated on the top of the alternator. Two systems of ignition are fitted, magneto and battery and coil (timer system), and the whole plant represents a very neat lay-out to meet the special conditions involved. A very elaborate system of silencing the exhaust was originally designed, but it was found afterwards that two standard Parsons silencers in tandem was all that was necessary.



A Shock Absorber Bedplate.

Schemes for the Relief of Unemployment.

We are reminded by the Minister of Transport that on July 18th the Lord Privy Seal and the Minister of Transport met representatives of the electricity supply industry to discuss with them methods by which the amount of employment provided by the industry could be increased in order to assist the Government in dealing with the problem of unemployment. As a result of this conference the Electricity Commissioners trust that before the end of the year they will be able to report to the Ministers that they have before them evidence of a substantial increase in the activities of the industry, since they are confident that the supply industry as a whole is in a position to make an important contribution towards the solution of the problem of dealing with the unemployed.

From the Commissioners' figures it appears that the annual capital investment in transmission and distribution sytems has grown from under £8,000,000 in 1922-23 to over £16,000,000 in 1927-28. If expenditure continues to increase, as there is every reason to suppose it will, the outlay during the next five years should be over £100,000,000, and the Commissioners are of opinion that a considerable percentage of this could be accelerated so as to fall within the next two years without throwing any unreasonabe burden on the industry.

The industry is assured of a rapid and continuous growth extending over at least the next decade and, therefore, is in a position to expend capital, even in advance of immediate requirements, with certainty that any unremunerative period would be short.

The experience of the most progressive undertakings has shown that the demand for domestic supplies is such that the time has come when established undertakings operating in urban areas should now consider the practicability of completing there distributing network in the built-over areas in the next two years.

The view of the Commissioners is that it is proper to lay mains in any street in which there is a reasonable prospect that, within the next three years, the annual revenue will defray the actual additional outgoings.

The Commissioners have noted the great encouragement to the development of domestic supplies afforded by the adoption by undertakers of schemes of assisted wiring and of extended facilities for hire and hire-purchase of apparatus. They venture to urge on undertakers the initiation of such schemes wherever possible.

In many residential areas the existing mains have been laid suitable for giving lighting supplies only, and if the larger demand arising as the result of a progressive programme of development is to be met, the mains must be supplemented to render them sufficient for this purpose. The Commissioners suggest that this work is suitable to be undertaken at the present time.

The Commissioners also desire again to call the attention of undertakers to the advantages in the generality of cases of changing over from a direct current to an alternating current supply, where such a supply can be made available. As a result of the construction of the national transmission system within the next few years, supplies throughout the country generally will be given in bulk as alternating current. Any delay in starting a change of system which will ultimately be necessary, not only increases the cost thereof, but also postpones the time at which the full benefits of the National Scheme will be reaped.

The attention of undertakers is also drawn to the financial assistance for which they may be eligible under the Development (Loan Guarantees and Grants) Act, 1929, in respect of the cost of carrying out works in acceleration of normal development.

Commercial Motor Show.

CORRECTION.—In the review of the above-named exhibition (p. 881, November 15th issue) the title of the Equipment and Engineering Co., Ltd., was reversed. The error is regretted.

Mining Electrical Engineers.

The incoming chairman, Mr. S. T. Richards, A.M.I.E.E., chief electrical engineer of Amalgamated Anthracite Collieries, Ltd., in the course of an address at the first ordinary meeting of the 1929-30 session of the Western District Sub-Branch of the Association of Mining Electrical Engineers at Swansea, said the increase in the use of electricity in collieries was remarkable. In the matter of electrical accidents, the main trouble was not with the apparatus, but the education of the man operating it. There were many collieries which were shut down to-day where, if cheap power had been available, the situation would have been reversed. Mining electrical engineers had contributed their share in lowering the cost of production to meet existing conditions. Colliery plants were to-day at a higher standard of efficiency than that of many of the other industries, otherwise they would not have survived; grouping of collieries had taken place which had lent itself admirably to the centralisation of power supplies.

An E.T.B.I. Whist Drive.

A whist and bridge drive held at the Cox Café, Cardiff, on October 16th, at which eighty people were present, realised the sum of £12 4s. 4d. for the funds of the E.T.B.I.

The Point Five Domestic Rate.

We are informed that the names of the following undertakings should be added to those given in the special supplement to the ELECTRICAL REVIEW of November 15th :—Birkenhead, Hamilton, Leigh, Sale, and Stretford, which offer tariffs including 0.5d. as a secondary charge.

Junior Institution of Engineers.

The forty-eighth sessional general meeting of the Institution was held in London on November 8th, when the annual report was presented and adopted, together with the annual accounts, which, despite certain special expenses, showed a balance of income over expenditure and a sound financial position. The ballot for officers resulted in the election of the following: *Chairman:* Stanley Dunlop; *vice-chairmen:* E. D. Gill and J. Foster Petree; *hon. treasurer* W. M. Hurrell; *hon. editor:* C. E. Atkinson; *hon. librarian:* L. H. Ardley; *senior councillors:* J. Duguid, T. C. Morewood, and L. S. Atkinson; *junior councillor:* T. Harman; *hon. auditors:* W. H. G. Churchill, T. C. Morewood, D. B. Skinner, and F. A. Glidewell.

The Electrical Association for Women.

As a result of repeated requests from members of the Electrical Association for Women for a series of practical lectures on simple repairs, the following three have been arranged to be given by Mr. H. Bourne, of the Hendon Electric Supply Co., Ltd. :—November 21st, "How Electric Heaters, Cookers and Cleaners are Wired, and why they get out of Order"; November 28th, "The Construction, Use and Maintenance of Electric Kettles, Toasters, Irons and other Small Apparatus"; December 5th, "Practical Hints about Bells, Batteries and Wireless Sets."

Members of the Birmingham and Midlands Branch of the E.A.W. spent a profitable afternoon, on November 12th, at the new works at Derby of the Macintosh Cable Co. The party saw the complete manufacture of cables for industrial and domestic wiring.

Speaking at the inaugural meeting on November 15th of the Plymouth and District Branch of the E.A.W., Viscountess Astor, M.P., said she was confident that a branch of the Association would be particularly helpful to Plymouth, which was going through an industrial revolution.

Miss Caroline Haslett, director, explained the aims and objects of the Association. She said that the old-fashioned, unhygienic methods in the home were an extraordinary feature of domestic life and she was not sure that women were altogether free from blame for it. What they wanted was an entirely new mental outlook about home work. The home was still the biggest industry in the world, and it ought to be run with efficiency and with the most up-to-date appliances that science could give them.

Mr. R. Lovell Dunstan, chairman of the City Corporation Electricity Committee, expressed his belief that the formation of a local branch of the Association would prove a very material and useful asset to the electricity undertaking.

The branch secretary, Miss M. Hollest, stated that a number of lectures and visits had already been arranged for the members.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting held on November 11th, Mr. W. E. Lang was in the chair, and Mr. W. E. Highfield opened a discussion on "Temporary Expedients in Engineering." He felt that the modern trend towards specialisation in one branch of the profession at an early age, necessarily limited the range of practical experience. He described some remarkable repairs in a variety of situations.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Our Bradford correspondent says that despite the fact that the Socialists have now a majority over both other parties on the Bradford City Council, Mr. L. JESSOP (Liberal), head of Messrs. Jessop & Boydell, Ltd., electrical contractors, has been re-elected deputy chairman of the Parks Committee; Alderman J. W. LONGLEY (Con.), consulting electrical engineer, has been re-elected chairman of the Electricity Committee; and Mr. IRVINE SMITH (Lib.), has been re-elected chairman of the Tramways Committee.

The *Australian Electrical Times* reports that Mr. J. P. DUGGAN has been appointed general manager in Australia of Messrs. Siemens Bros. (Aust.), Ltd., with head office at Sydney. Mr. H. P. SLIPPER, the general manager (then located at Melbourne), recently passed away at the early age of 45 years, after four years' illness. Before he went to Australia Mr. Slipper was with the B.T.H., at Rugby, and with Siemens Bros.' Dynamo Works at Glasgow.

The *Electrical World* reports that Mr. OWEN D. YOUNG, chairman of the board of directors of the General Electric Co. (U.S.), was presented with the Roosevelt Medal for Distinguished Service at a dinner in honour of the seventy-first birthday anniversary of Theodore Roosevelt, held on October 27th in New York.

Dr. YASUJIRO NIWA, chief engineer of the Nippon Electric Co., Ltd., of Tokio, Japan, was recently signally honoured by the Institute of Electrical Engineers of Japan, which awarded him the Asano prize for "meritorious achievement in electrical science, electrical engineering, and electrical invention." The distinction has been three times awarded in the past. The first to be honoured was Dr. H. NAGAOKA, professor at the Imperial University of Tokio. Dr. H. HO, professor at the Imperial University of Tokio, author of extensive researches on high voltage problems, was the second recipient, while in recognition of his work on high power transmission Dr. S. BEKKU was the third to win the honour.

Mr. R. F. DIXON, for nearly ten years manager of the Mansfield & District Tramway Co., has been appointed general manager of the Oxford Motor Services, Ltd.

Mr. R. H. PALMER, of Palmer's Publicity Service, was married to Miss Muriel Cracknell at St. Martin's-in-the-Fields on November 15th. Major Clifford H. Palmer, the bridegroom's brother, acted as best man.

The marriage took place at St. George's Cathedral, Madras, on October 26th, of Mr. ROWLAND WRIGHT, assistant superintendent of the Madras Electric Supply Corporation, Ltd., and Miss Gladys Ethel Stubbs.

The marriage has taken place at Leamington of Mr. ERIC R. KNIGHT, B.Eng. (of the Leicestershire and Warwickshire Electric Power Co.), and Miss Dorothy E. Southorn, of Moreton-in-Marsh.

Councillor H. K. BEALE has been re-elected chairman of the Birmingham Corporation Electric Supply Committee.

It is announced that the Nobel Prize for Physics for 1928 has been awarded to Professor O. W. RICHARDSON, Yarrow Research Professor of the Royal Society and Director of Research in Physics at King's College, London. The award is made for Professor Richardson's formulation of the law known by his name governing the motion of electrons emitted by hot bodies. The 1929 Physics Prize goes to M. LE DUC DE BROGLIE for his researches into the movements of electrons.

A correspondent desires to get into touch with Mr. LESLIE GOSLAND, B.Sc., late of the British Electrical Industries Research Section, Colville power station, Wallsend, Northumberland.

Sir WILLIAM NOBLE, whose visit to Australia has already been mentioned, is stated in the Melbourne papers to be paying a three months' visit to the Commonwealth to study broadcasting, telegraph, and telephone developments. He is also inspecting the automatic telephone system just installed at Hobart for the Government by his company, the General Electric Co., Ltd.

Herr L. V. VEREBELY, chief electrical engineer of the Hungarian State Railways, has been appointed Professor of Electrotechnics at the Technical High School of Budapest. He will continue to act as advisory engineer to the State Railways on electrification questions.

To fill vacancies caused by the death of Sir John Gatti and the resignation of Mr. Herbert Morrison, Minister of Transport, the Special Committee on Traffic of the L.C.C. recommends the appointment of Mr. W. H. GREEN and Mr. CHARLES W. MATTHEWS as members.

Obituary—Mr. J. W. LIEB.—Mr. John William Lieb, senior vice-president of the New York Edison Company, and a pioneer of the American electric light and power industry, died on November 1st, at New York, after an illness of several months. His death was mentioned in our reference to the late Signor Guido Semenza last week. Mr. Lieb was born in 1860. He was an associate of Mr. Thomas A. Edison in designing and installing equipment for Pearl Street Station, in New York City, which was put into operation on September 4th, 1882. He obtained a degree as mechanical engineer in 1880 and in the same year began his employment with the Brush Electric Co., of Cleveland, Ohio, as draughtsman. He devoted the whole of his business life to the electrical industry. In November, 1882, he was selected by Mr. Edison to go to Milan, Italy, to direct the installation of the Milan Edison station. On the organisation of the Società Generale Italiana di Elettricita, Sistema Edison, he was appointed its chief electrician, then chief engineer, and finally technical manager and director

of stations. The Milan station was started in regular service in March, 1883. In 1893, there was put into service, under Mr. Lieb's direction, in Milan, one of the earliest trolley systems in Italy. For his pioneer work in connection with the introduction of electric light and power service throughout Italy and the installation of the electric trolley system in Milan, he was decorated by the Italian Government Knight Commander of the Royal Order of the Crown of Italy, and was later promoted to Grand Officer. In 1925 he was made "Ufficiale" of the Order of S.S. Maurizio e Lazzaro, and in 1928 was honoured by the French Government, receiving the decoration of Officer of the Legion of Honour. In 1894, Mr. Lieb returned to America and engaged in manifold electrical activities, and duly became a member of innumerable engineering and scientific institutions in the United States and Europe.

SIGNOR E. RAZZOLI.—The death is reported from Catania, Sicily, at the age of 70 years, of Signor Emilio Razzoli, a well-known Italian electrical engineer. The deceased was for some years chief engineer of the municipal electricity supply undertaking in Milan, and later consulting engineer of the Società Generale Electrica della Sicilia.

MR. G. W. CARPENTER.—Mr. Gilbert W. Carpenter, assistant manager of the Scarborough Corporation electricity undertaking, died last week at Scarborough, aged 50 years. He was present three days before his death at a meeting in connection with the dispute between the Scarborough Electricity Committee and the Electrical Power Engineers' Association. He had been in ill-health for some time.

MR. F. J. MUDFORD.—We regret to record the death which occurred on November 13th, after a brief illness, of Mr. Francis John Mudford, M.I.E.E., of Arrow Electrical Works, Jackson Road, Holloway, N.7. Mr. Mudford who was 72 years of age became an associate of the Institution 48 years ago (1881) and a full member in 1891.

MR. E. L. FLEMING.—The *Devon Gazette* reports the death, on November 9th, of Mr. E. L. Fleming at the age of 75. Mr. Fleming, who was a brother of Professor Sir J. A. Fleming, is said to have been the originator of the scheme for producing electricity by means of the tidal power of the River Exe.

Wills.—Mr. WALTER SCOTT, at one time chairman of the Rochdale Electric Co., and a newspaper proprietor and printer, left £105,578 gross and £94,038 net personalty.

The Times records that the late Mr. H. T. SCHIASSI, of Vevey, Switzerland, who was for over 34 years contract engineer to Callender's Cable and Construction Co., Ltd., left £10,430 net personalty.

Mr. A. C. JONES, of Messenger & Sons, electric light and gas fittings manufacturers, left £167,625 gross and £115,786 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Chas. Preston & Co., Ltd.—Private company. Registered November 13th. Capital, £3,500 in £1 shares. Objects:—To acquire the business carried on by L. St. Alphonse as Chas. Preston & Co., and to carry on the business of agents for and factors of electrical, wireless, and builders' appliances, fittings and accessories, &c. The first directors are:—L. St. Alphonse, 51, Baronet Road, N.17, merchant (director of Electrical Engineers, Ltd.); W. R. Curtis, 23, Coniston Road, Muswell Hill, N.10, electrical salesman; E. G. B. Carrs, 14, Ridge Road, Winchmore Hill, N.21. Qualification, 500 shares. Registered office: 41, Berners Street, W.1.

Standard Switchgear, Ltd.—Private company. Registered November 14th. Capital £1,000 in £1 shares. Objects: To carry on the business of marketers of electric lighting, cooking, heating, power and all other kinds of electrical fittings and equipment, &c. The directors are: J. B. Rudkin, (managing director), "Mount Joy," Hill View Road, Rayleigh, Essex; Mrs. Violet G. Rudkin, "Mount Joy," Hill View Road, Rayleigh, Essex. Qualification: £100 shares. Secretary: Ellen M. Rudkin.

Vul-K-Lec, Ltd.—Private company. Registered November 12th. Capital £1,000 in £1 shares. Objects: To acquire the business of electric vulcaniser manufacturers and suppliers carried on by B. Griffith, H. de Lisle Crawford and W. H. Fawcett at 58, South John Street, Liverpool. The directors are: B. Griffiths, 31, Cromer Drive, Wallasey; H. de Lisle Crawford, 3, Rodney Street, Liverpool; W. H. Fawcett, 59, Donaldson Street, Liverpool. Qualification: £100 shares. Registered Office: 58, South John Street, Liverpool.

British Universal Illuminations, Ltd.—Private company. Registered November 13th. Capital £100 in 1s. shares. Objects: To acquire the business of the British Illuminations Company and H. Stanley Smith & Co., electrical contractors, and to carry on this and the business of electrical installation and illuminating contractors, &c. The first directors are:—H. S. Smith, 61, Southwater Road, St. Leonards-on-Sea, electrical contractor; W. A. Leer, 31, Quebec Street, W.1, electrical salesman; A. L. Williams, 33, Tower Road, St. Leonards-on-Sea, sales manager (electrical goods). The first two are joint managing directors.

Armaflex Parent, Ltd.—Registered as a private company November 18th. Capital, £25,000 in 22,500 8 per cent. preference shares of £1 each and 50,000 ordinary shares of 1s. each. Objects:—To acquire from the Relative Engineering Co. the patent rights under the provisional No. 2,046/29 for improvements in or relating to cable making and light machines in the name of F. J. Humphrey and to carry on the business of cable manufacture, engineers, metal and wood workers, &c. The directors are:—Brig.-Gen. Sir Wm. T. F. Horwood, G.B.E., K.C.B., D.S.O., 5, Powis Terrace, W.11 (director Philips Lamps (England), Ltd.); J. Neale, 15, Acacia Road, St. John's Wood, N.W.; C. L. F. Clutterbuck, 17, St. James's Avenue, Brighton; A. W. Torry, F.L.A.A., 27, Dundonald Drive, Leigh-on-Sea (director Relative Engineering Co., Ltd.); F. J. Humphrey, 9, Woodford Road, Forest Gate, E. (director Relative Engineering Co., Ltd.). Secretary: J. Culverwell. Registered office: 27, Queen Victoria Street, E.C.4.

Official Returns of Electrical Companies.

P. N. Forbes, Ltd.—W. G. Grosvenor-Launder, Northend, Henley-on-Thames, ceased to act as receiver or manager on April 9th, 1929. (Notice filed November 9th.)

Electrical Finance & Securities Co., Ltd.—Satisfaction to the extent of £2,080 (making total redeemed £4,100) on November 1st, 1929, of trust deeds to secure debenture stock authorised by resolutions of the board dated April 28th, 1927, and May 3rd, 1928, and resolution of the company dated May 6th, 1927, registered on July 29th, 1927, and July 10th, 1928.

Wolf & Morgan, Ltd. (former Wagner Electric Supplies, Ltd.). Particulars filed of £2,000 debentures authorised October 23rd, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

City Wireless Co., Ltd.—Capital, £100 in £1 shares. Return dated June 28th, 1929. 52 shares taken up. £52 paid. Mortgages and charges, £500.

H. E. Keen & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £502 paid. £5,498 considered as paid. Mortgages and charges, nil.

Magnetic Separators, Ltd.—Capital, £500 in £1 shares. Return dated May 7th, 1929. All shares taken up. £500 paid. Mortgages and charges, £600.

Fraser Mares, Ltd.—Capital, £1,500 in £1 shares. Return dated August 9th, 1929. 1,080 shares taken up. £1,080 paid. Mortgages and charges: £600.

Bennett & Fountain, Ltd.—Capital, £3,000 in £1 shares. Return dated January 30th (filed June 4th), 1929. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

Geo, Bray & Co., Ltd.—Capital, £160,000 in 80,000 preference and 80,000 ordinary shares of £1 each. Return dated May 14th, 1929. 55,000 preference and 55,000 ordinary shares taken up. £7 paid. £109,993 considered as paid. Mortgages and charges, £40,000.

Shoreham & District Electric Lighting & Power Co., Ltd.—Capital £27,500 in £1 shares. Return dated April 25th,1929. 17,329 shares taken up. £10,829 paid. £6,500 considered as paid. Mortgages and charges at date of return, £16,200. Issued October 1st, 1929: £1,300 6 per cent. ten-year notes.

Colombo Electric Tramways & Lighting Co., Ltd.—Capital £150,000 in £10 shares. Return dated June 11th, 1929. 13,084 shares taken up. £840 paid. £130,000 considered as paid. Mortgages and charges, nil.

Sheerness & District Electric Supply Co., Ltd.—Capital, £75,000 in £1 shares. Return dated May 28th, 1929. All shares taken up. £75,000 paid. Mortgages and charges, nil.

Hendon Electric Supply Co., Ltd.—Capital, £250,000 in 150,000 preference, 96,095 ordinary and 3,905 unissued shares of £1 each. Return dated April 4th, 1929. 96,095 ordinary and 150,000 preference shares taken up. £223,930 paid on 150,000 preference and 73,930 ordinary shares. £22,165 considered as paid on 22,165 ordinary shares. Mortgages and charges: £200,000.

Walters Electrical Manufacturing Co., Ltd.—Capital, £18,000 in £1 shares. Return dated June 27th, 1929. 16,875 shares taken up. £6,875 paid. £10,000 considered as paid. Mortgages and charges, nil.

Pope's Electric Lamp Co., Ltd.—Capital, £25,100 in 25,000 preference and 100 ordinary shares of £1 each. Return dated July 24th, 1929. 23,579 preference and 100 ordinary shares taken up. £5,254 paid. £18,425 considered as paid. Mortgages and charges, nil.

Dawlish Electric Light & Power Co., Ltd.—Capital, £20,000 in £1 shares Return dated July 4th, 1929. All shares taken up. £20,000 paid. Mortgages and charges: £2,750.

Electric Construction Co., Ltd.—Capital, £400,000 in 100,000 preference and 300,000 ordinary shares of £1 each. Return dated July 2nd, 1929. 62,780 preference and 300,000 ordinary shares taken up. £116,490 paid on 36,490 preference and 80,000 ordinary shares. £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges: £122,530.

Howard Asphalt Troughing Co., Ltd. (formerly Howard Conduit Co., Ltd.).—Capital, £20,000 in 19,000 ordinary and 1,000 deferred shares of £1 each. Return dated June 4th, 1929. 5,007 ordinary and 1,000 deferred shares taken up. £4,007 paid. £2,000 considered as paid. Mortgages and charges, nil.

Yorkshire Switchgear and Engineering Co., Ltd.—Capital, £10,000 in £1 shares. Return dated May 21st, 1929. 5,382 shares taken up. £2,382 paid. £3,000 considered as paid. Mortgages and charges, £3,922 5s.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Capital, £8,100,000 in 1,500,000 7 per cent cum. preference, 2,500,000 5 per cent. preference, and 4,100,000 ordinary shares of £1 each. Return dated April 9th, 1929. 1,500,000 7 per cent. preference, 1,538,952 5 per cent. preference, and 4,007,681 ordinary shares taken up. £6,088,123 10s. paid on 1,500,000 7 per cent. preference, 730,555 5 per cent. preference, and 3,857,645 ordinary shares, leaving £76 10s. in arrears. £958,433 considered as paid on 808,397 5 per cent. preference, and 150,036 ordinary shares. Mortgages and charges, £4,296,458.

Kidderminster and District Electric Lighting and Traction Co., Ltd.—Capital, £100,000 in 5,000 preference and 5,000 ordinary shares of £10 each. Return dated August 6th, 1929. 5,000 preference and 4,700 ordinary shares taken up. £97,000 paid. Mortgages and charges, nil.

Alton District Electricity Co., Ltd.—Capital, £5,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Sunray, Ltd.—Capital, £2,000 in £1 shares. Return dated May 16th, 1929. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Barron & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 23rd, 1929. 1,619 shares taken up. £19 paid. £1,600 considered as paid. Mortgages and charges, nil.

Tudor Accumulator Co., Ltd.—Capital, £100,000 in 8,800 "A" and 1,200 "B" shares of £10 each. Return dated April 8th, 1929. All shares taken up. £29,000 paid (being £10 per share on 2,600 "A" and £2 10s. per share on 1,200 "A" shares). £71,000 considered as paid (being £10 per share on 5,000 "A" and 1,200 "B" and £7 10s. per share on 1,200 "A" shares). Mortgages and charges, nil.

Standard Electric Co., Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated June 14th, 1929. 3,077 preference and 5,000 ordinary shares taken up. £4,377 paid. £3,700 considered as paid. Mortgages and charges, £300.

Standard Telephones & Cables, Ltd.—Capital, £2,000,000 in £1 shares. Return dated July 16th, 1929. All shares taken up. £906,000 paid. £1,094,000 considered as paid. Mortgages and charges, nil.

Yesly Electrical Supplies, Ltd.—Capital, £1,000 in 500 "A" and 500 "B" shares of £1 each. Return dated July 1st, 1929. 150 "A" and 401 "B" shares taken up. £551 paid. Mortgages and charges nil.

East Cornwall Electricity Supply Co., Ltd.—Satisfaction in full on October 18th, 1929, of debenture dated February 27th, 1926, securing all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Wadebridge and District Electric Supply Co., Ltd.—Satisfaction in full on July 11th, 1929, of debentures dated February 1st, 1923, securing £1,500, of which only £500 was issued.

Malmesbury Electric Supply Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated June 28th, 1929. 1,945 preference and 2,800 ordinary shares taken up. £4,745 paid. Mortgages and charges, nil.

City Notes.

Radiovisor Parent, Ltd.

The first annual general meeting of this company was held on November 15th, Lieut.-Col. The Hon. A. C. Murray presiding. The chairman said that the company was in a strong financial position, having cash resources amounting to over £113,000. One of the most remarkable technical developments of recent years had been the use of light-sensitive processes for various applications, especially in connection with talking films. The advent of the Radiovisor light sensitive bridge had placed the selenium cell in the forefront of light-sensitive devices. Having such a selenium bridge a large field of activity was opened up and the possible applications were numerous. It was not the board's policy to go in for manufacturing apparatus on a large scale other than the Radiovisor light sensitive bridge, and they were prepared to co-operate with manufacturers and make arrangements with them to take over the manufacture and sale of appropriate applications. In cases where firms or individuals wished to make use of the bridge for some particular purpose or application of their own it was the policy to lend bridges and to assist them in developing their ideas. The patent rights and trade marks for the world, excepting Great Britain, Northern Ireland, the Isle of Man, and the Irish Free State, had been sold to Radiovisor Foreign & Colonial, Ltd., in which the parent company held a substantial interest. The foreign company had already made considerable progress, having concluded an agreement with Siemens & Halske A.G., of Berlin, for the exclusive rights to manufacture and sell throughout Europe. Intensive development work was already being carried out in their laboratories and workshops, which should lead to active business. The report and accounts were adopted.

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st last shows a profit of £22,828, to which is added £42,655 brought forward, making a total of £65,483. From this is deducted the dividend on preference shares paid in January and July, leaving a balance of £52,983. The directors recommend a dividend of 2½ per cent., free of tax, on the ordinary shares, leaving £34,233 to be carried forward. The report states that a marked recovery has taken place at Persan both as regards profits and turnover. The new steam and power plant at Silvertown is practically completed, and its installation will materially reduce expenses in the future.

Although the accounts show an improvement on last year, the trading profits have not improved correspondingly. The turnover is less than last year, although the actual output is well maintained. The directors fully realise that increased profits are now dependent mainly upon larger sales, and their most serious attention is being given to this problem.

Buell Combustion Co., Ltd.

The second annual meeting of this company was held on November 6th, Mr. J. W. Murray (chairman) presiding. In presenting the report and accounts, the chairman said that the profit and loss account showed a further debit of £10,431, which was largely accounted for by the cost of redesigning and reconditioning old plant and the drastic writing off of obsolete stock, &c. The position of the company had materially improved since the last annual meeting, and interest in the use of pulverised coal had been steadily increasing. He looked forward with optimism to the future of their interests under the management of the Howden-Buell Co. The report and accounts were adopted.

Beaver Trust, Ltd.

Addressing the annual meeting of the company on November 14th, Mr. J. G. B. Stone (chairman) said since the previous balance sheet was issued the outstanding call of 12s. 6d. per share on the then recently issued 100,000 shares had been

paid up, and subsequently the approved scheme for the subdivision of the capital into preference and ordinary shares was carried through. The whole of the capital, with the proceeds of the £150,000 debenture stock, had been invested. An analysis of investments showed that 28 per cent. was invested in electricity supply companies. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Atlas Light & Power Co.—£467 5 per cent. debenture stock.

County of London Electric Supply Co.—217,050 ordinary shares of £1 each, fully paid, Nos. 6,603,335 to 6,820,384.

Electrical Finance & Securities Co.—23,838 ordinary shares of £1 each, fully paid, Nos. 76,163 to 100,000; £2,700 5½ per cent. debenture stock.

Underground Electric Railways Co. of London.—7,988 ordinary shares of £1 each, fully paid, Nos. 7,267,080 to 7,275,067.

Erinoid, Ltd.

Presiding at the recent annual meeting, Mr. A. Binnie said that during the first half of the financial year there was a decrease in sales owing to the prolonged winter. It was not possible to get shipments to the North of Europe delivered, as the ports were frostbound and the railways blocked by snow. There was an improvement in the latter half of the year, however, and the total for the twelve months was rather in excess of that of the previous year. The considered view of the board was that it was better to discontinue the interim dividend for the present, but to issue a half-yearly report. The report and accounts were adopted.

Liskeard (Cornwall) Gas and Electricity Co., Ltd.

Presiding at the annual meeting on November 15th, the chairman (Mr. W. H. Huddy) said that after writing off £1,400 for depreciation, and paying for heavy repairs and renovations to plant out of current revenue, a profit had been made on the year of £1,215. He stated that the consumption of electricity in Liskeard had increased by 25 per cent. during the year. A dividend of 7½ per cent. was declared on the ordinary shares.

Metals Coating Co., Ltd.

This company has issued, for information only, particulars of its registration and objects. Its capital is £150,000 in 5s. shares. It proposes to acquire a factory at Dudley to work the metal-coating process briefly described in our issue of October 25th, 1929, p. 708, which process, according to a prospectus before us, is employed by a large number of electrical manufacturing concerns in this country and abroad.

Indo-European Telegraph Co., Ltd.

The shareholders have been informed that the board has practically concluded arrangements with Imperial & International Communications, Ltd., under which an offer by that company to purchase the shares of the Indo-European Telegraph Co. at the price of £55 per share should be made in the near future.

Melbourne Electric Supply Co., Ltd.

Subject to confirmation at the annual general meeting it is proposed to pay the usual final dividend on consolidated ordinary stock of 5 per cent. actual, making 10 per cent., free of tax, for the year ended August 31st last.

Bolckow, Vaughan & Co., Ltd.

At meetings of the 5 per cent. cumulative preference shareholders and ordinary shareholders on November 12th, proposals for the amalgamation of the company with Dorman, Long and Co., Ltd., were approved.

Para Electric Railways and Lighting Co., Ltd.

A dividend on the 6 per cent. cumulative preference shares at the rate of 3 per cent., less tax, has been declared on account of the year ending November 30th next.

British Thomson-Houston Co., Ltd.

The directors have decided to pay a dividend on the 7 per cent. cumulative preference shares for the half-year ending December 15th, less tax at 4s.

Montreal Light, Heat and Power Consolidated.

A dividend on common shares of 60 cents per share for the quarter ending December 31st, less tax, at 4s., has been declared.

Madras Electric Supply Corporation, Ltd.

An interim dividend of 2½ per cent., tax free, has been declared on the ordinary shares, as last year.

French Companies.

The *Société Française Radioelectrique* records a net profit of 3,459,000 fr. for 1928-29, as compared with 2,026,000 fr. in the preceding year.

The *Société de Constructions Electriques de Nancy* has decided to increase the rate of dividend from 9 per cent, in 1927-28 to 11 per cent. for 1928-29, the net profits having been 755,000 fr. and 933,000 fr. in the two years, respectively.

The *Société d'Electro-Metallurgie de Dives* reports net profits of 35,558,000 fr. for 1928-29, rising to 47,697,000 fr. with the balance brought forward. It has been decided to pay a dividend of 135 fr. per share and to carry 23,342,000 fr. forward.

Stocks and Shares.

TUESDAY EVENING.

THE New York Stock Exchange has stepped in officially to do what it can in order to mitigate the disasters that have befallen so many speculators, and also real investors, in the United States, by reason of the slump, and the panic which followed it, in Wall Street just lately. One slump was succeeded by another with a rapidity almost bewildering, and it was this blow upon blow which demoralised the market, for in most movements of similar kind, the severity of a slump can be measured by the abruptness of the recovery that follows. The New York Federal Bank reduced its rate, and there is talk of the Bank of England following this example. The New York Stock Exchange is closing once more this week at one o'clock each day, and altogether on Saturday. The President of the Republic, together with some of the other Government officials, are taking steps to alleviate the distress caused in America by the result of the over-speculation which rushed up prices to absurd levels. The upshot of it all is that a good many rallies have occurred, and prices are generally steadier. From the lowest levels touched, there has been a substantial improvement. Utility stocks and shares, in which the recent fall has been most pronounced, are better with the rest. That everything is not yet well can be judged from the restlessness that prevails in Brussels, Amsterdam, and some of the other Continental centres. The Stock Exchange will soon be talking about the advent of the Christmas holidays as being a cause for quietude of business. Certainly the present week has contributed but little more than bread-and-butter business, though it is something to the good to have the atmosphere a little clearer, and to observe that confidence is returning by slow degrees.

Home Railway Market.

One of the stocks which suffered severely in the recent slump was Metropolitan consolidated, which fell to 57¼ at one time. It regained a couple of points in a single day, and has since advanced to 60¼. The flatness was due to the necessity for stock being sold in order to provide money for the meeting of obligations incurred elsewhere. The strike of 'busmen turned out to be a small affair, and Underground Electric income bonds, together with the shares, which had been put down sharply by reason of the labour trouble, had no difficulty in recovering their previous positions. Districts are a point lower at 72. The result of the new five per cent. conversion issue, the price of the scrip being now about par, has had no effect upon the gilt-edged securities of the Home Railway market. Prior-charge stocks retain their previous levels, and scarcity of supply begins to make itself felt as a market factor.

Electricity Supply Shares Fall.

Heavy falls took place in some of the principal of the home electricity supply companies' shares. Bournemouth & Poole have shed 3s. 9d. to 56s. 3d., Scottish Power 1s. 6d. to 28s. 6d., and Clyde Valleys ½ to 1¼. Urban ordinary are a florin down at 35s. The chief weakness amongst London shares is that in County of London ordinary, a fall of 2s. 3d., reducing the price to 48s. 3d. Metropolitan added to their 5s. loss, of last week, a further drop of 2s. 6d. reducing the price to 36s. 3d. The new shares, offered at 30s., gave way at one time to 1s. 9d. premium, as against the opening price of 8s. premium when the market started. Later there was a recovery to 4s. 9d. premium. The new Midland Counties are quoted about 3d. premium, and Scottish Power new shares, at 27s. 9d. Isle of Thanet ordinary, at 31s., show a fall of 3s. 6d.; Northamptons, which were 47s. last week, have been down to 37s., and this—Tuesday—evening stand at 42s. The main cause of the heaviness lies in the impression that if America has lost more money than she can afford over utility and railroad shares, she will be unable to implement the various schemes which, according to rumour, have been in the air for some time past, and in which the names of County of London, Northampton, Isle of Thanet, and several others were mentioned. Shares in any of the companies of which Americans have recently been credited with a desire to obtain control, and whose shares have been bought, presumably, for this purpose, appear to be the principal centres of weakness. At the end of the last and at the beginning of the present week, however, a better tendency supervened. Provincial shares suffered more than those of the London group, the reason being that, as there was greater scope for movement in the former,

prices had been put up more vigorously than those of the latter. Atlas ordinary are 9d. up at 27s. 3d. British Power and Light dipped to 13s. before rallying to 14s. They look reasonably cheap as a speculative investment.

Dollar Stocks.

After the extraordinary falls which occurred earlier in the month in the stock and shares of American utility companies, the movements during the past few days may be considered almost insignificant. Montreal Light, Heat, & Power, for instance, at 115¼, are no more than 4½ down. Pennsylvanias fell from 80 to 70, but have since recovered to 80½, showing a gain on the week of half a dollar. Power Corporation of Canada, at 77½, are 5½ down. American Telephone & Telegraph rose 12 to 227, which goes against 245 a fortnight ago. International Telephone & Telegraph, at 70, are 5 points lower on the week. Shawinigan, at 75½, show a drop of 3½. Brazilian Tractions, in which there continues to be a very active market, gained 3 points at 42, but the preference fell 5 to 135. Hydro-Electrics have come up from 32 to 34½, though a day or two earlier the price was 37. Mexican Light & Power common shares are a further 5 points lower at 75. The movements are irregular; it will be observed, reflecting in all probability the position of the speculative account as it has prevailed in New York; that is to say, if there were a big bull position in any of these stocks, the price would have to give way more sharply than in others to which the speculator had been paying less attention.

Further Declines.

British Electric Traction came down from its last week's price of 1,325 to about 1,200, from which latter figure there was a recovery to 1,250, leaving a fall on the week of 75 points, which is only half the drop shown by the previous week's quotation. London & Suburban Traction preference are lower at 9s., but the market in a good many of the less active stocks and shares has become so quiescent as to be nearly nominal. Hastings & District Electric Trams 5 per cent. debenture is marked down from 47½ to 26½, a drop of 21 points. Perak Hydro-Electrics weakened to 12s. 6d., and the debenture to 105½. Melbourne Electric ordinary stock gave way to 170. Calcutta Electrics weakened to 52s.

Indo-Europeans' Big Rise.

Cables and Wireless stocks have again fallen, and fairly heavily. The company's "B" ordinary, which stood at 100 early in July, has been down to 35 during the past few days. At the latter level, buyers are attracted by the speculative possibilities, and the price recovered to 42½. A good deal of business has been going on in the company's 7½ per cent. "A" ordinary stock, the net change on the week being a fall of 2 at 79½. The 5½ per cent. preference weakened to 96½, in spite of the easier tendency of the money market and the corresponding improvement that this brought about in the stocks of sound investment character. Anglo-American preferred rose a point to 99½. The principal feature in this market, apart from the pyrotechnics in Cables & Wireless deferred, is a rise of 7½ in Indo-European shares, this lifting the price to 55. The company has received an offer to sell its shares at this figure, and presumably holders will be glad to hand over their interests at such a price. The highest reached this year was 57, and the lowest 45, while last year the respective figures were 48½ and 30. The company has been paying 10 per cent. dividends, tax free, on its shares, which are of the unusual nominal value of £25 each. Globe Telegraph and Trust ordinary weakened to 23, because of the fall in Cables & Wireless stocks. The preference remain unchanged at 10½. Marconi Marines have receded to 2 1/16. Telephone Manufacturing dropped to 3s. 6d. International Automatic Telephones remained at 35s., and Automatic Telephones, although quoted officially at 37s. 6d., are not actually as good as this in the market. Postal Telegraph 5 per cent. debenture remains at 87.

The Manufacturing Group.

Shares in the manufacturing companies are again disposed to be lower, though Callenders stand out as a bright exception at 3½. This shows a gain of 2s. 6d. A similar fraction has been lost by British Insulated ordinary at 3½, while Johnson and Phillips are 3s. 9d. down at 35s. Henleys fell back to 5½, being 5s. down. British Aluminium lost 1s. 9d. at 44s. 6d. Siemens at 27s. 6d. are unaffected by the interim dividend of 2½ per cent. The India-Rubber, Gutta-Percha Company made a profit in the year ended August 31st, 1928, of £236, while for the twelve months ended August this year, the profit came to £22,800. A great deal of this has been saved from expenses. In the report, the directors point out that the new plant at Silvertown is practically completed, and that its installation will materially reduce future expenses. The price of the shares remains unchanged at 11s. 3d. The highest price touched this year and last year was 17s. 6d. In both of these periods it has been down to 10s. 3d. The 5 per cent. debenture at 90½ shows a gain of a point. A fair amount of animation characterises Associated Electrical Industries ordinary, where the price of 29s. 6d. shows a fall on the week of 3s. General Electrics, on the other hand, at 45s., are 1/16 higher. Iron and Steel shares lean to the easier side, with Babcock & Wilcox 1/16 down at 58s. 9d. Vickers keep about 7s. 10½d. The rubber share market is slightly less heavy upon a faint recovery in the price of the produce.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price Nov. 19 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	56/8	—3/9	5 6 9
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	22/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1⅞	—⅛	... ...
County of London	1	7	10	48/3	—2/3	4 3 4
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—⅛	4 11 3
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/-	—6d.	5 1 10
Metropolitan	1	9	9	35/3xr	—⅛	4 19 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	27/-	—1/-	4 16 4
Mid. Elec. Power	1	15	8	33/9	—9d.	4 14 10
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—9d.	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/-	+6d	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—6d.	5 7 8
Scottish Power	1	8	8	28/6	—1/6	5 12 3
South London	1	8½	8½	26/6	—	5 6 8
Urban Ordinary	1	7	7	25/-	—2/-	4 6 0
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	32/-	—1/6	5 0 0
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 13 8
Metropolitan	£	8	8½	60½	+½	5 15 8
do. District	„	4	5	72	—1	6 19 0
Underground Electric	£1	5	7	32/-	+1/-	6 7 3
do. do. Income	Bonds	6	6	105	+3	5 14 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	99½	+1	6 0 7
do. Def.	„	1½	1½	24¾	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96½	—1	5 14 0
do. A 7½ Ord.	„	—	—	79½	—2	... ...
do. B Ord.	„	—	—	42½	—5	... ...
Globe Tel. and T. Ord.	10	10	10	23	—½	*4 7 0
do. do. Pref.	10	6	6	10¾	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	55	+7½	*3 12 9
Marconi-Marine	1	12½	15	2 1/16	—1/16	... ...
Oriental Telephone Ord	1	12	12	21½	—	... ...
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref.	5	6	6	9 1/16	—	9 16 0
do. do. 5% Deb.	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	„	5	5	1250	—75	... ...
do. do. Pref. Ord.	„	8	8	134½	—	6 8 6
Brazil Traction	100	7	8	42	+3	4 15 3
Brit. Columbia Elec. Rly. Pref.	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	9/-	—6d.	... ...
London United Tram Deb.	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	65	—	7 13
Mexican Light Common	100	Nil	Nil	75	—5	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...
Manufacturing Companies.						
Assoc. Elec. Ord.	1	6	—	29/6	—3/-	4 1 4
Babcock & Wilcox	1	13	15	58/9	—1/16	*5 2 0
British Aluminium Ord.	1	10	10	44/6	—1/9	*4 10 5
British Elec. Transformer Pref.	1	7	7	15/-	—	... ...
British Insulated Ord.	1	15	15	3½	—⅛	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3½	+⅛	4 0 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 8
Crompton Parkinson Ord.	5/-	—	80	20/6	—	7 6 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 3
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4½	—⅛	4 4 5
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	9½	+1/16	4 9 0
Henley	1	25	20	5½	—½	5 6 9
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	35/-	—1/16	5 14 3
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	23	—	5 4 2

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during October.

It was to be expected that during October our electrical exports would recover from the very low level touched in the preceding month. The October Board of Trade returns show that the recovery was a substantial one, the total being the highest since September, 1926; they also show, however, that electrical imports continued their rapid upward movement and for the first time passed the million-pound mark.

Considering the exports first, it will be observed that the increase of £595,040, as compared with the September total, was spread over all the items with the single exception of carbons, which registered a decline of £1,456. Unenumerated electrical goods and apparatus contributed most to the increase (£128,079), while insulated wires and cables, the largest item in the list, showed a rise of £103,886. The machinery section as a whole advanced by £118,489, but failed to reach the 1928 level for the completed portion of the year. Although the exports of submarine cable were not abnormal, the telegraph and telephone section recorded an increase of £196,408. As compared with October, 1928 (a truer comparison) the increase in the total was not so great but was still very satisfactory. Unenumerated goods and apparatus experienced the greatest rise (£115,269), while insulated wires and cables stand out with an advance of £109,919. The telegraph and telephone section as a whole rose by £167,194. On the other hand, the total value of machinery exports fell by £10,697 on account of a decrease of £22,416 in traction motors. Batteries and accumulators also showed a substantial decrease (£19,546).

As we have already mentioned, imports again registered a considerable increase, the total being £224,492 above that of the preceding month. As in the case of the exports only one item showed a decrease—non-submarine telegraph and telephone wires and cables fell by £3,564. The greatest rise was that of £55,587 in the machinery section. Four other items were mainly responsible for the remainder of the increase, *viz.*, glow lamps (£38,440), unenumerated goods and apparatus (£35,882), batteries and accumulators (£35,756), and telegraph and telephone instruments and apparatus (£34,560). It is perhaps worthy of notice that the imports of the last class and of glow lamps were about equal to the exports of these classes. In three or four items imports exceeded exports, notably in the case of batteries and accumulators. As compared with October, 1928, the imports were nearly 55 per cent. higher, the actual rise being £356,625. About half of this increase was attributable to telegraph and telephone instruments and apparatus. Large advances were also made by unenumerated goods, glow lamps and unenumerated machinery. The exports of previously-imported goods and machinery recorded a further rise.

The subjoined table shows how our October exports of electrical machinery were distributed, and the figures are compared with those for the corresponding month of last year :—

Destination.	Oct., 1928. £	Oct., 1929. £	Inc. or dec. £
European countries ...	99,887	149,180	+49,293
Japan	5,172	19,062	+13,890
South America ...	56,919	36,962	−19,957
South Africa ...	23,514	47,346	+23,832
British India ...	183,350	112,258	−71,092
Australia	54,111	67,420	+13,309
New Zealand ...	29,614	18,378	−11,236
Canada	18,460	31,313	+12,853
Other countries ...	90,707	69,118	−21,589
Totals ...	£561,734	£551,037	−£10,697

As is generally the case nowadays, the exports were almost equally divided between Empire and foreign markets. It is noteworthy that while an Empire market —India—was responsible for the largest decrease, the Continental market accounted for the greatest rise. The 60 per cent. increase in the case of Canada may be considered satisfactory; in the first ten months of the year the Dominion's share was valued at £242,291, against £174,288 in the corresponding period of 1928.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct., 1929.	Inc. or dec. as compared with Sept., 1929.	Inc. or dec. as compared with Oct., 1928.	Electrical imports for Oct., 1929.	Inc. or dec. as compared with Sept, 1929.	Inc. or dec. as compared with Oct., 1928.	Electrical re-exports for Oct., 1929.	Inc. or dec. as compared with Sept., 1929.	Inc. or dec. as compared with Oct, 1928.
Electrical goods and apparatus (unenumerated)	£343,331	+£128,079	+£115,269	£212,323	+£35,882	+£70,645	£11,846	+£685	+£3,439
Insulated wires and cables ...	344,971	+ 103,886	+ 109,919	88,598	+ 6,468	− 3,995	1,232	+ 105	+ 253
Glow lamps	74,832	+ 35,452	+ 16,757	73,125	+ 38,440	+ 47,344	842	− 121	+ 148
Arc lamps and parts ...	3 541	+ 2 226	+ 2,611	7,396	+ 6,323	+ 2,750	24	− 65	+ 19
Batteries and accumulators ...	87,732	+ 1,361	− 19.546	132,026	+ 35,756	+ 17,169	1,086	+ 433	+ 421
Meters and instruments ...	33,127	+ 7,606	− 3,144	49,901	+ 9,667	+ 22,206	460	− 234	− 672
Carbons	486	− 1,456	− 66	12,953	+ 5,269	+ 3,108	101	− 27	− 15
Switchboards (not telegraph or telephone)	5,978	+ 2,989	+ 2,161	243	+ 104	+ 98	12	+ 12	+ 12
Electrical Machinery—									
Electrical machinery (unenumerated)	330,197	+ 84,766	+ 1.970	193,454	+ 55,587	+ 40,130	11,271	+ 2,118	+ 2,684
Railway and tramway motors	22,260	+ 5,219	− 22,416	—	—	—	—	—	—
Other motors and generators...	198,580	+ 28,504	+ 9,749	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	143,072	+ 7 ,571	+ 85,917	448	− 3,564	− 3,731	—	—	—
Submarine telegraph and telephone cable	98,823	+ 53,211	+ 62,998	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	238,650	+ 71,623	+ 18,279	236,956	+ 34,560	+ 160,901	5,347	+ 2,528	+ 4,535
Totals	£1,925,580	+£595,040	+£380,458	£1,007,423	+£224,492	+£356,625	£32,221	+£5,434	+£10,824
	Exports			Imports			Re-Exports		
Inc. for ten months	+£747,190			+£1,433,605			+ £23,676		

Frequency Control.

Some Notes on the London Power Company's Installation.*

THE gradual passing of the isolated generating station supplying its own network in favour of linking-up large groups of power houses all feeding into a common system, has rendered obsolete the present haphazard methods of frequency control in favour of a scheme which will ensure a rigorously correct frequency throughout the area. When a number of power houses are connected to a common transmission system, it becomes necessary to divide the total load, either according to some pre-arranged programme, or by instructions issued from time to time by a control engineer, or, as he is sometimes called, a "load dispatcher." If a power station is to increase its share of the load, it can only do so by giving more steam to the turbo-alternators, thereby tending to increase the frequency. As a result, the other interconnected stations lose some of their load, and in the absence of some pre-arranged system they probably increase their steam in order to regain their load. Thus, the frequency is still further increased, and this goes on until the engineer at one of the stations proceeds to lower the frequency. The other stations then find that they are carrying more than their share of the load, and take similar action; thus the process repeats itself, with inevitable hunting and "load pinching," as it has not inaptly been called.

To overcome this trouble, it is now generally agreed that only one station on such a system must control the frequency, whilst each of the other stations supplies its predetermined load. "Controlling the frequency" in this sense necessarily carries with it the supplying of whatever surplus power may be required to make good sudden variations in the load, and the criterion of whether more or less power is required is no longer the voltmeter, but the frequency meter. For this purpose, the ordinary indicating frequency meter is altogether inadequate, partly on the score of limited accuracy and slight differences in calibration between individual instruments, but still more owing to the fact that small temporary variations in frequency are inevitable, and usually without significance. It is, moreover, almost impossible for the operator to counteract them, whereas it is an easy matter for him to maintain an accurate *mean* or average frequency at all times, and that is actually what is required.

In view of the importance of the subject at the present time, a brief description of the method of frequency control adopted by the London Power Company will be of interest. The problem was that any one of the four existing power stations at Willesden, Grove Road, Deptford West, and Bow, as well as the new station at Battersea, when completed, should be in a position, at any moment, to take over the frequency control of the entire system. Further, that each station should have a continuous indication of the mean frequency of the system, or, if that station were temporarily disconnected therefrom, of its own mean frequency, so that it could be at any moment reconnected with the least possible delay. The system adopted for this purpose employs the Everett-Edgcumbe master frequency meter, which consists essentially of a dial provided with two pointers carried by concentric spindles, the one driven by a master clock and the other by a truly synchronous motor (the Warren motor). These pointers are so geared that when the frequency is correct, the speed of rotation of the motor-driven pointer corresponds exactly with that of the clock-driven pointer, and any gain or loss by one over the other indicates that the mean frequency is either too high or too low, as the case may be.

Fig. 1.—Master Frequency Meter at Ergon House.

Fig. 2.—Sub-frequency Meter.

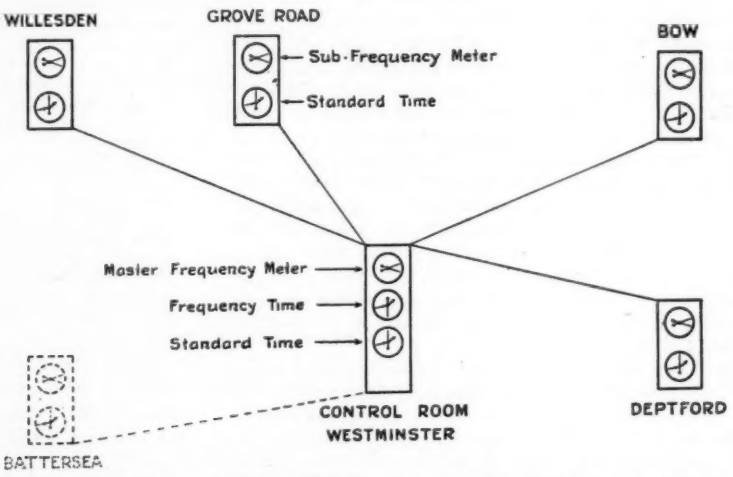


Fig. 3.—Lay-out of London Power Co.'s Frequency-Control System.

The master frequency meter installed in the central control room of the London Power Co., Ltd., at Ergon House, Horseferry Road, Westminster, is shown in fig. 1. In addition to the dial containing two pointers (the top dial), two ordinary clock dials having hour, minute and centre seconds hands, are provided. One of these dials (the middle one) indicates what may be termed "frequency time," and is operated by a Warren synchronous motor; the other indicates standard or reference time, and is driven from the master clock. Any difference in the rate of these two dials can only be due to a deviation of the frequency from its true value, and it provides an additional check on the readings of the two pointers on the top dial, and so serves as a stand-by, should it ever be required. In the usual Warren master frequency meter, the master clock consists of an electrically-wound, weight-driven, precision movement, with a seconds pendulum of invar steel, and can be relied upon to keep accurate time within a second or so per day. In the case of the London Power Co., however, it was desired to give each generating station an exact replica of the standard time dial in the control room at Ergon House, and this has been accomplished by installing there a Synchronome-driven master clock instead of the standard weight-driven master clock. The one-second current impulses from this

* See also ELECTRICAL REVIEW, June 7th, 1929, p. 1035.

clock are transmitted by means of pilot wires to the generating stations, in each of which a sub-frequency meter, as shown in fig. 2, is installed. The upper dial of this instrument is similar to the top dial of the master meter (fig. 1), that is to say, it is provided with two concentric pointers, one driven by a Warren synchronous motor from the station busbars, and the other by the current impulses from the master clock. The lower dial in fig. 2 is provided with hour, minute and centre seconds hands, and is likewise driven by the current impulses, and indicates "standard time." Fig. 3 shows, diagrammatically, the layout of the system.

It is ensured that so long as a station is connected to the system, the readings on the two dials will agree exactly with the readings on the corresponding dials of the master frequency meter in the control room at Ergon House. Should any one of the generating stations be disconnected from the main system for any reason, such as owing to fault conditions, and be therefore compelled to control its own frequency, it can do so by means of the upper dial, since the standard time hand thereon is synchronised from the control room. By this means, the station is at any moment in a position to connect once more to the system without the usual delay entailed in equalising the frequency by means of the synchroscope.

The concentrically mounted pointers on the upper dials of figs. 1 and 2 revolve once in five minutes, so that a difference of a few seconds in the position of the two hands is readily detected. On the assumption that the master clock is maintained correct within one second in 24 hours, the error in the average frequency will be less than 1/1,000th of 1 per cent. A difference of 5 seconds in the position of the two pointers on the upper dial is easily discernible, and this corresponds to a difference of 0.005 per cent. in the mean frequency. This figure may be contrasted with the allowable inaccuracy of 1 per cent. for an indicating frequency meter under B.S.S. 89/1929. Thus, instead of frequency measurement being one of the least accurate, it now ranks as the most accurate of all industrial electrical measurements. The London Power Co., in fact, finds that it is able, not only to *measure* the mean frequency with an accuracy of a few parts in a thousand, but actually in practice to ensure that *the frequency of its entire system does not differ from the true value* by more than an amount of this order.

It may be well to point out that whilst a properly controlled frequency is essential from the point of view of systematic load sharing between interconnected generating stations, it possesses innumerable advantages for the consumer. An absolutely synchronised time system is provided, and every consumer has at his command, from the nearest wall plug, a simple and almost ideal means for operating timepieces. These electrical clocks, termed "Synclocks," are operated by miniature synchronous motors. No master clock, batteries or other accessories are necessary, nor, of course, is any extra wiring; moreover, there is no winding, regulating or setting to be done. The fact that the London Power Co., and also many other supply undertakings, are accurataly controlling their frequency enables these "Synclocks" to be used by any consumer connected to their a.c. mains, and forms an ideal system of accurate time-keeping.

Two Municipal Supply Developments.

Extensions to the existing power station at Stoke-on-Trent and a bulk supply sub-station at Bermondsey were recently inaugurated.

Stoke-on-Trent Extensions.

AN electricity supply in the Potteries was first introduced in 1894, and the original station in Hanley had a capacity of 200 kW. With the formation in 1910 of the Pottery towns into the County Borough of Stoke-on-Trent, however, the need for more central works was recognised, and in 1913 the present power station was inaugurated with two 1,500-kW sets. Since the war additional plant has been installed at frequent periods, culminating with the starting up on October 31st last of a 12,500-kW set, which raised the capacity of the station to 37,500 kW. The latest extension is interesting in that it is the last to be made before the station passes from the control of the City Council to the North-West Midland Joint Electricity Authority in April next.

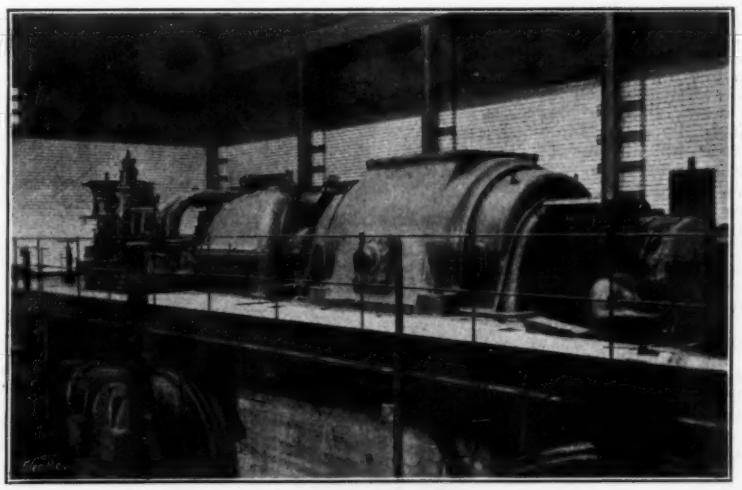


Fig. 1.—The New 12,500-kW Set at Stoke.

The new turbo-alternator, fig. 1, consists of a single-cylinder turbine of the impulse type, driving a 12,500-kW, 3-phase, 50-cycle alternator supplied by the Metropolitan-Vickers Electrical Co., Ltd. The working steam pressure at the turbine stop-valve is 250 lb. per sq. in., while the total steam temperature is 650 deg. F.; the machine speed is 3,000 r.p.m. A M.V. central-flow surface condenser installed with the turbine is designed to maintain a 28.45-in. vacuum at full load when supplied with 792,000 gallons of water per hour at 70 deg. F. It has a cooling surface of 16,250 sq. ft. Interesting points regarding the construction of the alternator are that the stator core and the stator winding at the neutral point have embedded thermo-couples, so that the actual temperature in the interior of the generator can be ascertained while it is under load. The quantity of cooling air required by the alternator is 30,000 cu. ft. per min., and this is dealt with by the maker's closed-circuit system of air-cooling, which includes an automatic alarm if the air temperature rises above a safe limit, and also dampers which can be opened to give cool air to the system. The exciter is of the overhung type.

The boiler house extensions have been carried out by Messrs. John Thompson Water-Tube Boilers, Ltd., and comprise two boiler units, each consisting of the company's "Delta" type boiler, with integral superheater, economiser, air heater, induced- and forced-draught fans, &c. Each boiler has a normal evaporation of 60,000 lb. of steam per hour at a pressure of 275 lb. per sq. in., the steam being superheated to 660 deg. F.

A new cooling tower has been supplied by the Davenport Engineering Co., Ltd. This is of the natural-draught two-chimney type, and is designed to deal with 450,000 gallons of water per hour. Extensions have been made to the e.h.p. switchgear by the addition of six metal-clad circuit-breaker units, with remote control apparatus, supplied by the Metropolitan-Vickers Electrical Co., Ltd. Each switch has a rupturing capacity of 350,000 kVA. The service transformer for the auxiliary motors of the new equipment was also supplied by this company, and is an 800-kVA, 3-phase unit. It takes power at 6,600 V and gives a supply at 415 V.

Messrs. A. Reyrolle & Co., Ltd., supplied the switchgear for the l.p. supply to the station auxiliaries. The existing board has been extended by the addition of a bus-bar sectionalising panel and one transformer panel, both type "B2," with a rating of 1,500 A, and a breaking capacity of 100,000 kVA. Four 400-A type "E" feeder panels with a breaking capacity of 25,000 kVA have also been installed to control the supply to the power distribution boards in various parts of the station.

The heavy cables in the power house have been supplied, jointed, and erected by Callender's Cable & Construction Co., Ltd., the wiring for lighting and small motors being carried out by Messrs. Barnett & Soans. An additional station 60-cell battery of 1,200 ampere-hour capacity on a ten-hour rating

has been supplied and erected by the Chloride Electrical Storage Co., Ltd.

The whole of the extensions were designed by Mr. C. H. Yeaman, the city electrical engineer.

The Bermondsey Sub-station.

A provisional Order, giving powers to supply electricity in a portion of the borough of Bermondsey, was granted to the Bermondsey Vestry in June, 1899, and later an additional provisional Order was granted to the Bermondsey Borough Council to supply the Rotherhithe area. Under these Orders

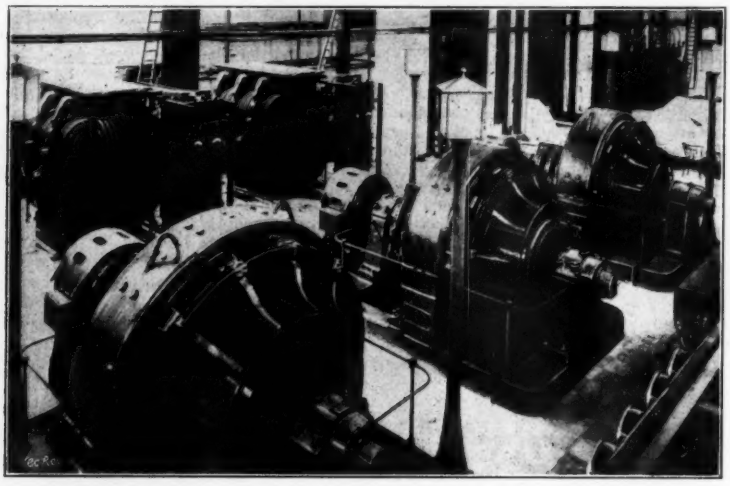


Fig. 2.—Convertor and Transformer Equipment at Bermondsey.

the undertaking commenced the generation and distribution and supply of electrical energy in January, 1902. Since the inauguration of the supply, a steady progress has been made necessitating extensions to the machinery and mains from time to time.

Early in the year 1923 the borough electrical engineer, Mr. J. G. Doran, A.M.I.E.E., was instructed to formulate a scheme in accordance with the Electricity (Supply) Acts, which was duly submitted and sanctioned. Under this scheme the new station is connected with the large generating stations supplying in bulk under the control of the Central Electricity Board. H.p. current at a voltage of 22,000 is received and transformed and converted to 480 and 240 volts d.c. for distribution throughout the borough.

The new bulk-supply sub-station, which was officially inaugurated on October 26th by the Mayor of Bermondsey, Councillor G. A. Howard, J.P., is to some extent remarkable on account of the economy of space embodied and the facility given for the most efficient working of the concern generally. On the main floor of the station are the machines and switchgear, and a feature is the extensive use of glazed bricks in the various pits and foundations. A 20-ton travelling crane spans the room. The upper floor is laid out as offices and stores.

The electrical equipment consists broadly of the e.h.p. switchgear, transformers and rotary-convertors, a main three-wire d.c. switchboard, and a further d.c. switchboard for the supply to the London County Council tramways. The e.h.p. switchgear was supplied by Messrs. A. Reyrolle & Co., Ltd., and is of their metal-clad horizontal draw-out design. It is built up into two switchboards, one board controlling the main incoming feeders and the cables therefrom to the second part, which controls the supply to the station machines. Each board is equipped with duplicate bus-bars throughout, and is fitted with solenoids for electrical operation. A slate control board is conveniently situated, and serves both e.h.p. boards.

The rotary-convertor equipment, fig. 2, consists of three 2,000-kW rotary convertors coupled to three 2,200-kVA oil-immersed self-cooled core-type transformers, and one 1,000-kW rotary convertor coupled to a similar transformer, each convertor being supplied with a self-synchronising starting panel. The convertors and transformers were supplied by the General Electric Co., Ltd., and are of that company's standard make. The larger convertors run at 500 r.p.m. and supply direct current to the main switchboard at 500 volts, while the 1,000-kW machine runs at 750 r.p.m. and is provided with tappings on its transformer and a change-over switch, so that it can either be used to supply 500 volts to the main switchboard or 600 volts to the tramway switchboard. Each machine is started up by means of a squirrel-cage motor mounted on an extension of the bed-plate. The d.c. voltage control is effected by means of reactances embodied in the transformers; this enables the voltage to be adjusted by simply moving the shunt field regulators, which are mounted on the control panels.

There is also one 1,500-kW rotary convertor, supplied from a 25-period, 6,600-volt system, which has been removed from a sub-station which is being superseded, and a further similar machine will be erected eventually.

The main l.p. 3-wire d.c. switchboard, fig. 3, which was supplied by Crompton Parkinson, Ltd., is believed to be one of the largest in the country; it consists of 27 panels, totalling approximately 80 ft. long by 8 ft. 6 in. high. The board consists of enamelled slate panels of high insulating quality, bushed with mica, and is designed in accordance with the latest Home Office and fire insurance regulations.

The whole of the cable work in this connection has been done by the Bermondsey borough council's staff, and the feature of the work is the regularity of the spacing of the cables and the exceedingly small length of cable actually in the building itself. Every cable is readily accessible, and the crossing of any one cable over others has been virtually eliminated. Outstanding features of this board are the simplicity of its design, the accessibility at the back, and the arrangement provided for easy manual control.

There is also another switchboard, designed and erected by the London County Council Tramways Department staff, which deals with the supply to the tramways in Bermondsey and a portion of Deptford. To a further board pilot cables from various parts of the network are brought, so that the pressures can be remotely recorded.

The station is designed for the total capacity of 12,000 kW. The whole of the plans and specifications for the electrical equipment and the supervision of the installation throughout, including the transfer of plant from the old to the new station, have been carried out by Mr. Doran and his staff.

Ships' Auxiliary Turbo-electric Drive.

A trial run was carried out on November 6th with the P. & O. mail liner *Mooltan*, to which an auxiliary turbo-electric propeller drive has been fitted, the motors being arranged in the propeller shaft and taking current from turbo-generators, which get their steam from the low-pressure cylinders of the two main reciprocating engines.

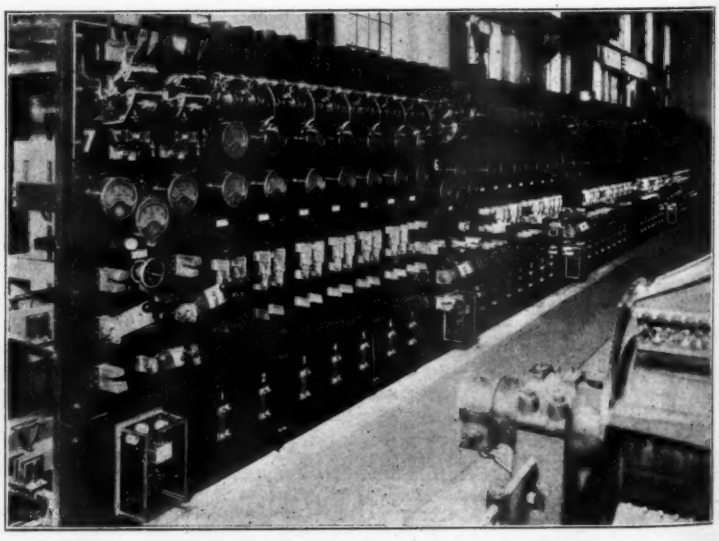


Fig. 3.—The Bermondsey D.C. 3-wire Switchboard.

Interesting results are expected from this important innovation in marine propulsion technique, which has been compared in its functions to supercharging Diesel engines. Extra speed and power can be obtained for a practically negligible increase in the fuel bill, and the electrical installation is very economical in space. This type of propulsion (see also Elec. Rev. November 1st, 1929, p. 766) is claimed to be doing more to restore steam to its former position in certain ship types than almost any other recent development.

The Inland Telegraphs.

Some causes and effects: an attempt to outline the author's idea of the function of the telegraph service in the future.

By T. E. HERBERT, M.I.E.E.

(*Extracts from chairman's address before the* NORTH-WESTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE inland telegraphs were bought by the State from the Companies in 1870, and it is now recognised that the £11 millions purchase price was too high. It was, indeed, only 12 per cent. less than the £12½ millions paid to the N.T. Co. in 1912 for the vastly larger plant of its telephone system. Those facts do not, however, explain the loss on the inland telegraphs to-day. At the transfer special rates for Press messages were inaugurated, and the improved facilities for news distribution were definitely in the interests of the general public. Indeed, no modern newspaper could exist without the aid of present-day methods of electrical communication; hence, the development of the newspaper was in no small measure rendered possible by the cheap Press message, which advantage was shared by the community at large. It would, therefore, be arguable that the special concession has been justified, but to-day there is no justification for any such subsidy of the public Press. In fact, all the great newspapers have private wires of their own, in order to save the delay inseparable from the transmission of messages between post offices and newspaper offices; in other words, the greater celerity amply justifies the very heavy charges which this policy entails.

It should not be overlooked that the inland telegraph system is the medium by which foreign messages are distributed to recipients throughout the kingdom, and thus perform a most valuable function for the community. At the transfer the charge was reduced to 1s. per message, and the system was extended, so that offices from which telegrams could be sent had increased to 14,222 by 1914. The telegraphs were not developed on purely commercial lines, but as a national service. The aim was to bring every centre of population within the range of communication, regardless of whether it would pay to do so. Commercial methods would, of course, have resulted in concentration on profitable business alone, and would have left villages in a continued state of isolation. A record of the total traffic is given below :—

Year.	Total Messages. (Millions.)	Inland Messages. (Millions.)
1870*	8½	—
1884†	33	—
1915‡	91	72
1920§	94	74
1925	67	49
1929	59	44

* Transfer to State.
† 6d. telegrams, 1885.
‡ 9d. ,, November, 1915.
§ 1s. ,, September, 1920.

The revenue from the service has never been sufficient to pay interest on the capital. Of the loss, Press messages represent £225,000 per annum. By 1881 the balance of receipts over expenditure had nearly reached the interest due on the stock, which position was, however, profoundly modified by the introduction of the 6d. telegram in 1885, that reform having been carried out deliberately by Parliament, in spite of the known loss that would occur. In 1925 the loss was £1,645,000 (which figure included £300,000 paid for war services) and in 1928 it was £1,381,000.

In 1913 some 64 per cent. of the total communications (telegrams, plus telephone calls) were sent by telegraph, whereas in 1926 the figure was only 36 per cent. of the total. In America 150 million telegraph messages were sent over the Western Union system alone during that year, and that figure was 2½ times the number handled ten years ago, which shows the vast difference between England and the States in the use of the telegraph facilities. The explanation is, however, quite obvious: we are a small country and our distances are short. If the telegraph is to be quicker than other means of conveying messages, the time available from the initiation to receipt of a message must be much less here than in America, where the distances are vastly greater. The greater time available for telegraphy brings with it differential charges based on distances and also on celerity. The advantages of evening up the load curve need no voicing.

It is reasonable to suppose that the number of messages that is sent direct by the sender to the recipient will tend to increase. A telephone message occupies an individual pair of wires for the whole time that the conversation takes place, whereas several messages can be sent simultaneously on a single telegraph wire by the Baudot multiplex and by voice-frequency telegraph systems; but the present tendency is towards the use of sub-audio telegraphy worked on telephone trunk circuits, or, alternatively, superposed on such circuits with thermionic valve reception of the signals. For example, a four-wire core affords three telephone circuits (two physical and a phantom) and over the centre of the phantom a telegraph circuit can be worked without affecting the telephony. At the telephone repeater stations all that is necessary is to connect across the central points of the telegraph superposing transformers, and consequently the plant cost is only a fraction of the similar cost of telephone trunk lines. There is, however, the fundamental difference that a telegram has to be signalled by hand, whereas the work of a telephone operator is confined to making and severing the required connections. Hence it is only over very long distances that telegraphy becomes the cheaper method of conveying messages. In the case of an Atlantic Ocean submarine cable the position is reversed, the operating cost in human labour being small in comparison with the plant cost. More human energy is employed in the transmission of a telegram than in setting up a telephone call, and on receipt a telegram has generally to be delivered by hand. In the case of country villages the telegraphs are still serving the purpose for which they were originally designed. Incidentally, many such telegrams are transmitted over telephone circuits to the nearest large telegraph centre.

To-day it is quite clear that the Wheatstone automatic system must disappear altogether, and it seems equally probable that multiplex systems will also have a very restricted field of utility in this country. In fact, Morse signalling, whether manual or automatic, is doomed, chiefly on account of its inefficiency in the use of human effort. It may be well to remark that the losses on telegraph service would not disappear if all the plant costs were eliminated entirely, and so the future line of development in so small a country as ours will not consist in plant-saving devices, such as multiplex, voice frequency, or automatic systems, but in the adoption of methods which obtain the results with the minimum expenditure of human effort. The deduction from this would appear to be that heavy expenditure on plant is amply justified wherever labour saving can be effected. At the moment the replacement of all forms of apparatus by "start-stop" telegraphs is beginning. Telegraphy is very largely mechanical in character, whereas in telephony the mechanisms used are of the simplest character. The teleprinter works at about 60 words per minute, but even that speed is inadequate to wipe out the loss on telegraphs. The manual re-transmission of messages is necessarily a costly process, and evidently must be avoided to the utmost extent. In the early days experiments were made in telegraph switching, but were abandoned. A comparatively elaborate system existed in Belgium some 30 years ago, and the metropolitan intercommunication system devised by Col. Sir Thos. Purves in 1900 (by which sub-offices in London were interconnected at a switchboard), owing to the decline in messages across London, due probably to the more intensive development of telephones, ultimately failed to justify its continuance. It is interesting to note that the first exchange was not for telephony, but for telegraphy, and was working prior to 1870 at Newcastle with Wheatstone A.B.C. apparatus; in 1884 it was converted to telephony.

What is likely to be the line of future development? Some twenty or thirty years hence the business community will have discovered that speeding up its methods will enable more buisness to be done with much less effort. There will, moreover, be such legislation in vogue as will prevent the recurrence of frequent financial upheavals, and will thus enable people to concentrate on useful work. Much more attention will then be available for concentration on doing things in the simplest, quickest, and most direct way, and the leisure thus obtained will certainly in the main be devoted to worthy objects.

Every business office will be equipped with a teleprinter, and by means of a dial form of automatic switching communication will be direct with the recipient. In the case of very small firms, possibly the telephone connection may be used for the dual purpose, or perhaps several small firms may share a single telegraph wire. The messages will be received on a form of receiving perforator in the main telegraph office

of the town to which the recipient is connected, and in that way the message will be stored and sent in automatically to the recipient as soon as his circuit is free. Several machines may be "lined up" on a rotary line-switch with messages for a single subscriber, which will discharge the messages in sequence, and enable them to be dealt with in a strictly routine manner. The telephone will, on the other hand, be used when discussion is essential.

A service of that type will need a large number of circuits, but they are already available, since it has been demonstrated that telegraphy can be worked at sub-audio frequency on telephone trunks without appreciable deterioration of the latter. When that source fails, voice-frequency systems, or even multiplex systems, controlled by precision vibrators as regards the division of line time will certainly meet the requirements.

There remains the problem of the delivery of purely private messages; when the recipient is not on the telephone (and the percentage of such messages to the total messages would tend to fall) there seems no alternative to delivery by messenger. If, however, the system as a whole can be made remunerative, that does not seem a very serious matter. The advantages of the plan outlined consists in transferring the human labour to the subscriber, but that does not represent any serious addition to his necessities, since the message can be telegraphed with just the same labour with which it would have in any case to be typed.

That the development postulated is by no means visionary is exemplified by the following extract from the *Wall Street Journal*, New York, U.S.A., July 27th, 1929:—

"The Bell system has developed a telephone typewriter which provides equipment and circuits and gives a service which permits subscribers to handle their own messages, telephone or telegraph, in their own way. Telephone typewriter instruments have to a large degree the flexibility of telephone instruments, and can be interconnected through suitable switchboards in the same manner. It is, therefore, quite feasible to provide a large number of subscribers in their business offices with these instruments, and to furnish wire interconnections between the subscribers as they may indicate their desires. The service need not be confined to a single city, but any subscriber in New York may be connected to any subscriber similarly equipped in some other city, the time required to complete the connection being of the same order as that required to complete a telephone connection between the same two points."

Salesmanship and adequate publicity are clearly essential to the early realisation of such a scheme. The engineering details would present no insuperable difficulties.

Radio-telephony Interference.

Extracts from a G.P.O. report on an investigation of interference by tramway and electric trolley-omnibus services with broadcast radio-telephony reception.

RADIO report No. 135, recently issued from the engineer-in-chief's office of the General Post Office, London, deals with interference with the reception of broadcast radio-telephony caused by tramways at Blackpool and tramways and electric trolley omnibuses at Birmingham.

Complaints of such interference had been received in the past from many districts, and no general remedy had been found for the trouble, although, in certain isolated cases, slight improvement had been effected by the alteration of aerial position and/or the use of a counterpoise "earth." It was known that the Fischer-plate type of overhead collection was in use on the Continent, and that its introduction into this country was imminent. It consists of a grooved-sliding collector about 4 ft. long by 4 in. broad, packed with grease and surmounted on a bow, the length being transverse to the collector wire. The spring tension on the bow is less than that on the normal trolley arm, and, in conjunction with the lubrication effected by the grease, greatly reduces overhead line maintenance cost, which reduction is the only reason for the adoption of the Fischer plate by local authorities, but it was thought that its use might at the same time reduce tramway interference.

Arrangements were accordingly made for tests at Blackpool in December, 1928, but, in the meantime, an English invention (the Dudgeon shoe) was made the subject of tests at Birmingham. This device, which consisted essentially of a trailing shoe behind the ordinary trolley wheel, is intended to bridge the gaps in the collector wire and to preserve contact when the trolley wheel passes over a suspension ear. Normally, the trolley wheel jumps at a suspension ear, an arc is produced, and the ear and collection wire become badly burnt; arcs also occur at all gaps in the overhead wire, and it was thought that the trailing shoe would minimise the burning. Under normal conditions, the arcing at those points may be definitely heard in a wireless receiver as sudden clicks as each ear or gap is traversed by the trolley. The Birmingham tests showed that the collector clicks were reduced when Dudgeon-shoe cars were used, but, at the same time, it was apparent that interference from other tramway sources was of far greater intensity and duration than the collector noises.

The overhead suspension system normally used for tramways is not best suited to plate collectors, since riding at the ears occurs when a plate traverses them. A special type of suspension ear, necessitating the use of a grooved (instead of a round-sectioned) conductor, obviates this defect, and its adoption at Birmingham is under discussion, whilst the standardisation of conductor, ears, frogs, and cross-overs to meet the requirements of plate collectors is in hand.

In December, 1928, at Blackpool, where the improved types of collector wire and suspension ears were in use, better conditions than at Birmingham obtained, and great improvement resulted from the use of a Fischer plate; collector and section clicks as heard on a portable receiver (2 h.f.-det.-2 l.f.) situated 10 yards from the tramway route being considerably reduced in volume. It was noted, as at Birmingham, that the greater interference was from other tramcar sources. In collaboration with the British Broadcasting Corporation, further tests were carried out at Blackpool during April, 1929, as were tests by the Post Office Radio Department on trolley-'buses and tramcars at Birmingham in July, 1929.

Two 500-volt d.c. traction motors were provided on each vehicle with series or parallel switching arranged at the controller; the main differences between tramway and trolley-'bus systems were therefore:—(i) absence of air-brake compressor motors in the railless (trolley) 'buses; (ii) overhead earth return in the railless system, giving (*a*) approximately double the number of suspension ears and section points; (*b*) an earth potential varying by about 50 volts on account of the long sections of return conductors, in conjunction with a chassis insulated by the tires; (*c*) supply and return feeders running parallel and fairly closely together, thus rendering the use of Fischer plates impracticable.

First tests showed that interference was present when no cars were in sight and that a background of interference (heard during the working hours of the tramway service) gradually decreased as the tramcars returned to the depot at night, with a corresponding building-up of the noise in the background with the commencement of the service in the morning. The background noise built-up considerably as any car passed the receiver at the observation point, and it was evident that a collective effect of all the cars then in service was being heard. Conclusive tests under those circumstances were impossible, and it was, therefore, arranged that trial runs of the test car and standard car should be conducted when no other cars were in service, as follows:—

(i) The insertion of a stopper circuit (tuned approximately to 19,000 metres) in the downlead from the Fischer plate to the controller, consisting of a coil of 100 μH inductance shunted by two 2 μF condensers in series, with their mid-point earthed; (ii) the transposition of the traction and compressor-motor series coils from the low potential side of the motors, *i.e.*, their arrangement as high-frequency chokes between the motors and overhead-collector wires; (iii) the provision of 2 μF condensers in series, with the mid-point earthed, across the series coils of the traction motors in their transposed position; (iv) the provision of 10 μF condensers across the brushes of the traction motors.

In the case of the railless trolley-'bus service the tests were as follows:—(i) provision of two 2 μF condensers in series across each traction motor; (ii) earthing the mid-points of the condensers in test (i) to the return conductor by means of another 2 μF condenser; (iii) insertion of the stopper circuit in the downlead, as for the tramway tests; (iv) transposition of the field coils. The results of the tests were as follows:—

Collector Systems.—The Fischer plate successfully eliminated the greater proportion of collector noises. The Dudgeon shoe also gave an improvement, but not to the same extent. At Birmingham, Dudgeon shoes are already being replaced by modified Fischer plates.

Tramways.—(i) The stopper circuit reduced the interference to about 80 per cent. of its original volume; (ii) the transposition of the field coils reduced the interference to about 45 per cent. of its original volume in the case of the traction motors and to about 20 per cent. in the case of the compressor motors; (iii) interference caused by both cars (test and standard) was less in wet weather; (iv) the tests on the efficacy of the condensers across the armatures and field coils

were carried out in wet weather, and no improvement was observed; however, they effected slight improvement in dry weather (bad rail contact) conditions;. (v) the effect of the field-coil transposition, armature condensers, field-coil condensers, and filter circuit, taken together, gave the following improvements :—

Noise due to car.	Starting.	Passing Section Point.	Passing Observation Position (40 yd. span).	Stopp'ng (Control'r Noises).
	%	%	%	%
Noise due to standard car taken as	100	100	100	100
Noise due to treated car (average of three independent witnesses) ...	10	45	40	15

(vi) Final tests between the treated and untreated cars during afternoon service hours showed that the background noise was about 15 per cent. of the strength of the Daventry (5 XX) signal. The standard car, in passing the observation point, increased the percentaege to 100 per cent. whilst traversing 800 yards; the treated car increased the percentage to 50-60 per cent. only, whilst traversing 200 yards.

Trolley-'Buses.—(i) The provision of condensers across the armatures, with or without an additional condenser to earth, gave no apparent improvement; (ii) the filter circuit alone gave about 10 per cent. improvement as regards volume: (iii) the transposition of the field coils also gave about 10 per cent. improvement in volume; (iv) The distance over which interference was experienced was only slightly reduced as a result of the field transposition and the filter circuit; (v) in certain localities, tramcar and trolley-'bus routes run in the same street, and, to avoid complications of the overhead systems, the return trolley is pulled down and anchored and an earth skate (consisting of a series of metal rollers metallically connected to the chassis) is trailed in the tramway rail; over routes of this description the improvement figures of 10 and 10 per cent. quoted above were increased to 15 and 75 per cent. for the stopper circuit and field transposition respectively; (vi) controller clicks were prevalent.

The conclusions drawn are that collector noises are greatly reduced when plate collectors are in use, and are practically eliminated when the overhead system is adapted fully to meet the plate collector requirements. Various types of plate collectors are in use, or are to be tried, in this country; while only the Dudgeon shoe and Fischer plate have been reported upon, it is thought that any plate or shoe collector will improve freedom from overhead clicks, compared with the usual trolley collector with its one-point contact. Plate collectors necessitate a bow or pantograph mounting, which obviates changing end-for-end at termini and gives an additional improvement, since there is no searching for the overhead collector by the driver, and a consequent absence of plops in wireless receivers. Occasional section points are so bad that the plate jumps-off the conductor when a trolley bow is used, and for this reason a vertical pantograph is preferable. The greater proportion of tramway interference is not from the collector system.

In the case of interference from tramways and railless 'buses using a skate, the transposition of the field coils of traction and compressor motors causes an immediate and considerable improvement. The improvement is present, but not so marked, on those trolley-'bus systems employing an overhead return. In view of the fact that tramway interference generally consists of a background of noise, due to all running cars, which builds-up on local receivers as individual cars pass them, the transposition of the traction and compressor-motors fields of all car operating in all towns is considered to be a practical means of reducing interference with broadcast radio-telephony. It is possible that such a wholesale transposition, in conjunction with the use of a plate, or similar method of collection, will render reception satisfactory so far as interference from tramway systems is concerned. The transposition of coils on the traction motors of trolley-'buses would also reduce interference, although on those systems employing an overhead return the improvement is not expected to be so marked.

Protecting Aluminium Against Corrosion.

Brief Descriptive Details of the Various Processes Applicable to the Metal and its Alloys.

THE first meeting of the 1929-30 session of the Electroplaters' and Depositors' Technical Society was devoted to the discussion of a paper read by Mr. H. Sutton, M.Sc., of H.M. Royal Aircraft Establishment, entitled "Some Recent Developments in Protective Coatings for Aluminium and its Alloys," which dealt in an interesting way with the latest developments and more particularly with those methods of which the author had personal experience.

The Paper.

The anodic oxidation process due to Bengough and his collaborators consisted in making the article to be treated the anode in a bath of 3 per cent. aqueous chromic-acid solution, the voltage being raised gradually from zero to 40 volts in 15 minutes, maintained there for 35 minutes, raised to 50 volts in 5 minutes, and maintained there for a further 5 minutes; by which means a protective coating of oxide was produced on all parts of the surface accessible to the electrolyte.

Graphite plates had been used extensively as cathodes and, in general, had given satisfactory service. It had been found possible to use clean steel plates as cathodes, or, when convenient, the tank itself, but stainless steel was preferable to ordinary steel for the purpose. Steel containing from 0.10 to 0.15 per cent. carbon and from 12 to 14 per cent. chromium had given the best results as a material for cathodes and tanks. That steel was not an easy one to weld, but, by the use of special technique, could be worked up into satisfactory tanks for anodic plant. In the operation of the anodic process there was a tendency for the chromic acid to be reduced at the cathodes and thereby rendered useless. The amount of reduction occurring was influenced greatly by the nature of the cathodes; for example, stainless steel of the type mentioned caused less reduction than any other material so far employed.

Chlorine and chlorides were very undesirable impurities and had given rise to considerable trouble, due to the fact that they caused breakdown of the anodic film and severe local attack on the aluminium or alloy during treatment in the normal manner. The chloride content of the electrolyte should not be more than the equivalent of 0.02 gram NaCl per 100 cc in order to avoid trouble from that cause.

The anodic process could be applied to aluminium, duralumin, and most aluminium alloys, but alloys containing more than 5 per cent. of copper had not proved capable of being treated. Duralumin, Y alloy, and similar alloys, could be treated equally well, whether in the final heat treated and aged condition, or after softening treatment. Provided that reasonable care was taken to avoid scratching the film, &c., pieces could be heat-treated satisfactorily after anodic treatment, but if a salt bath was used the film would be likely to be injured to some extent unless the salt, usually sodium nitrate, was of fairly high purity. There was a marked difference between the appearance of softened duralumin and of heat-treated aged material after anodic treatment, the former being rendered a dark grey, compared with the latter, which difference had occasionally proved of service as a method of distinction. Attempts to treat unsuitable alloys were very injurious to the bath, since pitting and solution of the aluminium occurred. Contact of aluminium or alloy under treatment with steels prevented the normal operation of the process; contact with brass resulted in rapid and severe attack on the brass during treatment.

The anodic oxidation process tended to open up and reveal clearly any defects, such as laps, seams, &c., in the metal occurring at the surface; also to disclose any attempts to plug up blow holes, holes drilled in wrong places, &c.

The protection against corrosion afforded by anodic films was much improved by the subsequent application of suitable paints, or enamel, or grease. Lanolin was much used for the purpose and was probably applied most conveniently in the form of a solution of white spirit 45 per cent., solvent naptha 45 per cent., and lanolin 10 per cent. by volume.

The Jirotka process consisted in obtaining a film on the surface by immersion in a bath of an aqueous solution of suitable salts, notably chromates and the salts of the heavy metals, kept at a moderate temperature. The treatment afforded considerable protection against corrosion. The variation in colour of the films obtainable suggested considerable scope for the process in decorative work.

Of the Stafford O'Brien process precise details were not available, but it was stated to consist of anodic treatment at low voltage in sulphuric acid containing a chloride, and it was claimed to be effective on aluminium alloys, including the high-copper alloys.

"Alclad," a form of duralumin having a coating of aluminium of high purity, was being produced, the object of the coating being to protect the underlying duralumin from corrosion. It was understood to be applied by means of a special casting process, and not to the sheet as such. The makers claimed that the attack by a corroding agent at cut edges was borne by the metal of the coating, and not by the duralumin.

"Calorising" consisted in packing the pieces to be treated in a mixture of aluminium powder, aluminium oxide, &c., and heating for a period of some hours. As a result the

aluminium was absorbed by the steel and the aluminium-rich layer at the surface had the effect of rendering the steel particularly resistant to oxidation when heated in air.

Another way of applying aluminium to steel was to electro-deposit a thin coating of cadmium on the steel, which was then preheated slightly and dipped in a bath of molten aluminium. The cadmium coating presumably melted and vaporised, permitting the access of the molten aluminium to the steel in the absence of air. When the steel article was removed from the bath it had a coating of aluminium resembling that of tin or zinc on work removed from hot-tinning or hot-galvanising baths. The aluminium-coated iron was very resistant to oxidation at elevated temperatures, and to corrosion at normal temperatures, as mentioned by Evans.

Nickel electro-deposits on aluminium had proved capable of affording a fair degree of protection against corrosion, but it was dependent upon the physical character of the deposit, since any discontinuities in the coating formed seats of corrosion of the underlying aluminium. Brook and Stott observed moderate resistance to corrosion of deposits of from 0.0001 to 0.001 in. thickness. H. K. Work had described methods of producing a roughened surface of aluminium and aluminium alloys by the use of etching solutions; his objection to sand-blasting was the equipment required. His nickel-plated samples bearing 0.0005 in. of nickel alone appeared to have given fair results in a salt solution test, *i.e.*, partial immersion in 1 per cent. NaCl, 1 per cent: $CaCl_2$ solution.

Cournot and Bary made corosion tests by partial immersion in artificial sea water, and nickel deposits on aluminium gave fairly good results. It was generally agreed the for the reasonable protection of aluminium and aluminium alloys, nickel deposits required to be free from pores and of moderate thickness. Practical experience of duralumin and aluminium plated with nickel had shown that unless the nickel deposit was moderately thick, *i.e.*, 0.0005 in. or more, and substantially free from pin-holes the deposit might be expected to blister and to become disrupted in places.

Zinc deposits had given promising results, and afforded better protection than nickel deposits under severe conditions. In the author's laboratory blasting with fine sand had been found the most consistent and generally satifactory method of preparing the work. Deposits from sulphate and cyanide zinc baths were being investigated for general and protective properties. At present the sulphate type of bath appeared to be preferable to the cyanide type, since a higher degree of protection was obtainable by the former when used with appropriate addition agents.

Cadmium deposits had given promising results. Cournot considered the cyanide type of bath the best for the purpose and obtained satisfactory results in corrosion tests, he also reported favourably on deposits of chromium on cadmium as a protection against corrosion. In the author's laboratory cadmium deposits had given good results, particularly on aluminium alloys. Although under marine conditions the cadmium of the coating appeared to be removed rather quickly, it appeared to leave a protective coating, probably consisting of mixed oxides of cadmium and aluminium.

The research at the Royal Aircraft Establishment on the use of electro-deposited coatings for the protection of metals against corrosion was now receiving assistance from the Department of Scientific and Industrial Research, and special investigations were in hand for the electro-deposition Committee of the Department.

Discussion.

THE CHAIRMAN (Mr. U. R. Evans) said that the properties of the light alloys were bound up with the invisible surface film, which Mr. Sutton had been the first to isolate, and the study of that film was therefore of great importance. Attempts to plate upon aluminium and its alloys formed an interesting study, since the difficulties in plating upon other metals were magnified, or "caricatured," resulting in valuable information. Coating steel with aluminium to prevent corrosion had been most promising in a comparison which he had carried out between the efficiency of various finishes. There was a big future for aluminium coatings if their performance was satisfactory and cost not abnormally high.

MR. E. A. OLLARD explained that when he was in Berlin in 1924 Dr. Leibreich had shown him a photograph of an aluminium electrode taken at the moment of the reversal of the current, which clearly showed the oxide film curling away from the surface.

DR. R. S. HUTTON (president) said that, although anodic oxidation was not new, *e.g.*, the aluminium rectifier had been known some 20 years ago, the idea had been lying dormant until Bengough and his colleagues at the Air Ministry had brought it to the point of commercial application. There was a very big potential field for the process, and licences to work the process were now being issued to manufacturers, chiefly in the aircraft industry, by the Department for Scientific and Industrial Research. There was also a big future for aluminium coatings, although an electro-deposit which was much thinner might give as good, and even superior, results.

MR. D. J. MACNAUGHTAN, referring to anodic oxidation, said it was essential that no other metal should be in contact with the aluminium being treated; such articles had to be disassembled, then reassembled after oxidation, injury to the film being then prone to occur. There was also the difficulty of suspending the article; also the appearance of the finish on certain alloys, such as duralumin after heat-treatment, was unsatisfactory showing up the crystal structure. The difficulty was to find a reliable process which would give, say, 90 per cent. satisfactory results.

MR. J. W. PERRING said that the variation of voltage could be carried out smoothly by means of one of the several types of device on the market. With regard to the breakdown of the film due to excessive voltage, the same thing occurred in the nodon valve, consisting of aluminium in a tri-sodium phosphate solution; if the voltage were high, sparks could be seen, the site of which showed pits in the aluminium. With that valve when using tantalum in a magnesium sulphate solution the anodic film could be seen to flake away.

MR. S. E. WEILL said the anodic process could now be satisfactorily applied to both aluminium and duralumin. Coloured finishes could be obtained afterwards without difficulty, and there was no difficulty with the generator. The solution was so cheap that it was best to scrap it periodically. The object should be suspended by aluminium wires secured tightly. The big difficulty in plating upon aluminium was that the latter oxidised so readily.

MR. S. WERNICK (hon. secretary) said there was no doubt about the efficiency of the anodic process as a method of protecting aluminium. It did not, however, seem necessary to carry out the step-up in voltage in the exact manner suggested, since he had obtained good results by using fewer stages of voltage adjustment and less time in the bath. He had examined a number of advocated methods of nickel plating upon aluminium some five years ago, but no one gave absolutely satisfactory results. The most promising method made use of an initial coat of iron obtained by a dip in an iron salt, and an aluminium article so plated over five years ago had withstood very well the atmosphere of a laboratory, and had subsequently behaved very satisfactorily in the salt-spray chamber.

MR. H. SUTTON replied to the discussion.

A Train Describing System.

The "B.P. Relay" Railway Signalman's Train Describing and Passengers Platform Indicator Apparatus.

A RAILWAY train describing system has recently been developed by the Relay Automatic Telephone Co., Ltd., in association with the British Power Railway Signal Co., Ltd., that employs some of the great variety of devices and circuits used in automatic telephony switching in application to railway traffic control, in which functional flexibility of the apparatus is a most valuable asset, while the design of the apparatus, consisting exclusively of simple relays, should ensure a high standard of reliability.

The following are typical instances of its application:—A signalman controlling a junction has obviously more than one procedure of passing trains forward, that adopted in each case being determined by the identity of the train. If the traffic is light and the local conditions are such that there cannot be more than one train between his own cabin and the immediately preceding cabin in the "up" and "down" directions, the necessary information may be conveyed to him telephonically, by bell code rings, or other such means. But, the heavier the traffic the more impracticable this procedure becomes, calling for an act of memory on the part of the signalman, which difficulty is claimed to be entirely overcome by the system as hereinafter explained.

A train description equipment becomes a necessary adjunct to the signalling system whenever the latter is such that several trains may be approaching between a signalman's cabin and the cabin immediately preceding it; for example, when the line between the two cabins is divided into several sections controlled by automatic signals.

Staff economies may frequently be effected by permanently closing down signal cabins and installing automatic signals operated by track circuits, which results in the condition referred to above and renders a train description system necessary in order to avoid the additional strain upon the signalman and the risk it involves through having either to memorise, or to write down, the descriptions of so many trains if they are conveyed to him in some other way.

An outstanding feature of the present system is the use of two wires only between the signal cabins. The method of transmitting train descriptions from one place to another is fundamentally similar to that employed in the Relay Co.'s well-known methods of automatic telephone switching, but it is important to recognise the exceptionally favourable conditions under which transmission is effected in train describing, as compared with the conditions obtaining in telephony. For

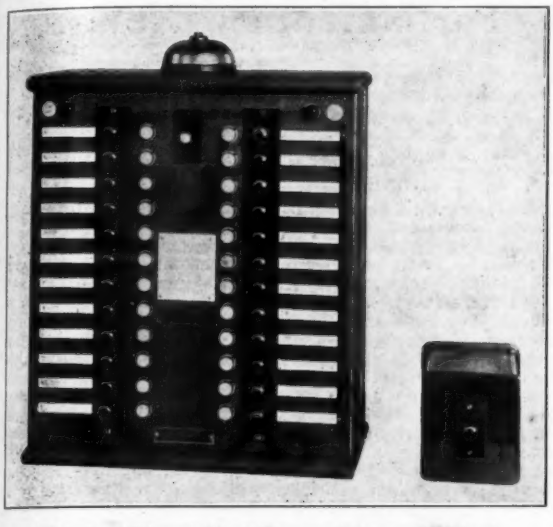


Fig. 1.—Dispatching Key and Lamp Cabinet.

example, in the latter case there can be no control whatever over the number of subscribers who may simultaneously attempt to make calls, and thus it sometimes comes about that momentarily more traffic is being offered than the equipment is designed to accept, with the result that certain of the calls may be lost, or mutilated, to obviate which momentary conditions would entail the provision of plant to an uneconomic extent. In addition, in auomatic telephony impulses are also sent by a great number of different dials, operated by different individuals, sending impulses over lines of different lengths and having different electrical characteristics.

The above remarks enforce the contrast with the conditions obtaining when the train describing system under consideration is used, for it is so arranged that descriptions are always transmitted one at a time from the same transmitting device to the same receiving device over the same line and at a speed which renders faulty transmission almost an impossibility.

Some of the different functions of the system, any or all of which may be embodied in a given set of equipment, are as follows:—

Setting Up.— Descriptions are, in the first place, "set up" by the depression of a key; if desired, an opportunity may be provided for the operator to check the description before actually transmitting it, or setting up and transmission may be effected by the same act.

Transmission.—This takes place on a numerical basis and consists of a series of trains or impulses, 1, 2, 3, or even 4, the

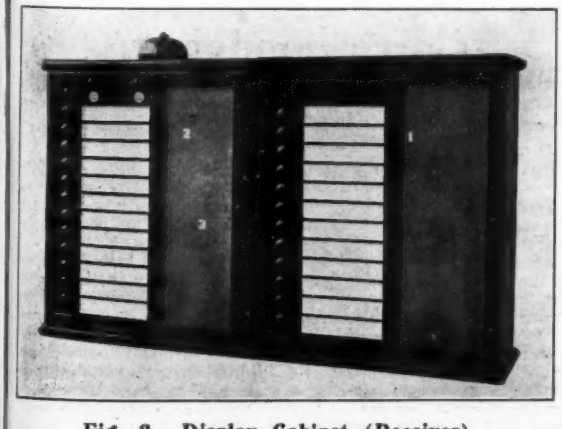


Fig. 2.—Display Cabinet (Receiver).

trains employed depending upon the basis of operation of the particular equipment. The descriptions may be transmitted either to one cabin, or simultaneously to a series of cabins, and remain displayed for the time being at the transmitting end as a reminder to the operator of the last train sent.

Receiving Equipment.—It may be designed to store any number of descriptions and so arranged that as many of the descriptions as may be desired may be displayed in the order of their arrival.

Re-transmission.—Re-transmission of descriptions from the receiving cabin may be effected either by the momentary depression of a key, or by the operation of a track circuit by the train itself; in any case it is not necessary again to set up a description which has been received. A receiving cabin's operator may himself set up descriptions which have not been received and transmit them in advance of the descriptions already stored and displayed in his apparatus. In any case when the receiving operator either re-transmits a description, or interpolates one of his own, the description last sent can be arranged to remain displayed for the time being as a reminder to the operator. The receiving operator can also, if desired, by the depression of a key eliminate descriptions from his apparatus without transmitting them.

Closing Cabins.—It may be arranged that on operating a locking key descriptions received in the signal cabin will be automatically transmitted, thus enabling the cabin to be closed down at times of light traffic without affecting the operation of the train describing system.

The 24-Way System.—Our illustrations show equipment which has already been supplied to one of the British railways, which is designed to cover 24 different descriptions, they being engraved on the labels shown in figs. 1 and 2. This particular equipment is operated upon a 3-digit basis and is thus capable of dealing with a thousand descriptions, each of which would be transmitted as a number. Since only 24 descriptions are actually made use of, the margin of safety against false descriptions is wide indeed, but in the remote event of a fault in transmission the apparatus will display the fact under the description "fault."

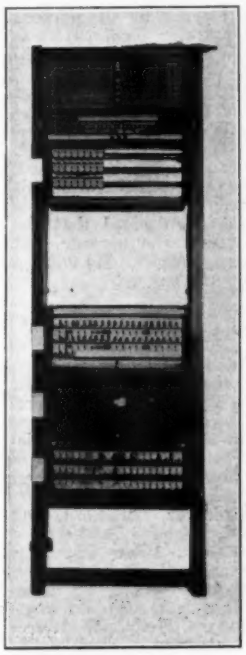


Fig. 3.—Dispatching Apparatus Rack.

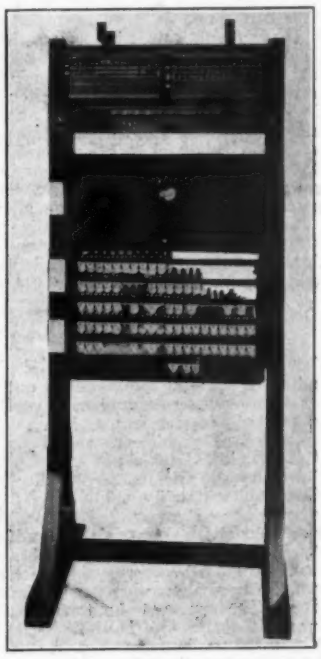


Fig. 4.—Receiving Apparatus Rack.

Referring to fig. 1, the depression of any key causes the corresponding description to be at once transmitted from the apparatus shown in fig. 3; when completed (at the most in two seconds) a lamp associated with the key lights and remains alight until the key is depressed to send a further description.

The receiving equipment in the present instance is designed to store six descriptions and display three of them, so that six descriptions may be sent before the receiving equipment becomes full up. If it is attempted to send a seventh description, the depression of the key for that purpose will be quite ineffective, except that the red alarm "line lamp" in the left-hand top corner of the display cabinet will light and remain alight only for so long as the distant receiving equipment remains full up. The separate key shown in fig. 1 is for the purpose of extinguishing the lamp corresponding to the last train sent when it is not desired to send further descriptions; for example, on closing down the cabin at night.

Figs. 2 and 4 show the receiving equipment, space being provided upon the apparatus rack (fig. 4) for re-transmitting facilities to be added later. The display cabinets merely consist of labels with a common ground-glass screen behind which are fitted stencils and lamps for displaying in the order 1, 2, 3, the next three trains to arrive.

As re-transmitting facilities are not initially provided on this particular plant, the positions for lamps at the left-hand side of the cabinets are for the time being occupied by blanks, but when re-transmission is brought into effect these lamps will constitute a reminder to the operator of the last description re-transmitted.

Platform Indicators.—It will be obvious that the apparatus has all the elements required for the purpose of platform indication to the public. merely by the construction of the apparatus shown in fig. 2 in a suitable form.

Numerical Displays.—Our illustrations show a form of display which may be termed descriptive, the 3-digit number employed for the transmission of any given description resulting in the lighting of an individual lamp much in the same way as the number employed in automatic telephone systems results in the ringing of an individual bell. However, it is quite simple to display the descriptions in their numerical form, either upon a 1-, 2-, 3-, or 4-digit basis as may be required by particular conditions.

Legal.

Willesden U.D.C. v. Whittaker Ellis, Ltd.

THE hearing was resumed and concluded at the Marylebone County Court on November 15th, before Judge Snagge, of the action in which the Willesden Urban District Council sued Messrs. Whittaker Ellis, Ltd., of 121, Victoria Street, Westminster, S.W., public works contractors, to recover £44 4s. for loss sustained through the alleged negligence of the defendants' servants. The claim set out that on March 6th last the defendants, acting as contractors for the Metropolitan Water Board, were working in High Road, Church End, Willesden, being engaged in opening the road for the purpose of tracing and repairing a leak in a water pipe. It was alleged that the workmen engaged on the work were negligent in that they allowed an instrument to damage a h.p. cable, allowing the water to enter it, which caused a short circuit. Owing to this, 27 yd. 2 ft. of the electric cable was rendered useless, and the plaintiffs claimed £44 4s. in connection with this and loss sustained. The defendants denied that their servants were negligent in causing the short circuit, and further denied that any wedge or other workman's instrument caused the damage alleged.

Judge SNAGGE, after a lengthy hearing, decided that the wedge had entered the cable, so causing the damage, but absolved the workmen concerned from all blame. He entered judgment for the plaintiffs for £44 4s. and costs.

Lamps Ordered by Telephone.

THE obtaining of goods by fraud, in many trades, has been causing trouble at Huddersfield and other West Riding towns for two years or so, and as a result of recent complaints in respect of electric lamps, local electrical dealers have been warned by the police to be on guard against orders by telephone, followed by a messenger. When Mr. Frank Hirst, a Dewsbury electrician, received an order for three dozen electric lamps to the value of £6 3s. recently, the police were informed, and arrested Douglas Whitaker, Bradford, and Martin Hewitt, electrician, Bradford. Meanwhile, between the Dewsbury order and arrest, Messrs. Alfred Crowther, Ltd., Huddersfield, received a telephone order for 50 lamps, and the boy who called for the lamps was followed by detectives. The order to the Dewsbury firm was supposed to be for a local picture house. That to the Huddersfield firm purported to be from Mr. T. W. Broadbent, electrician, of East Parade, who was supposed to need the lamps for a mill job. Neither the picture house manager nor Mr. Broadbent had given any such orders. With regard to the Huddersfield case, Hewitt was last week sent to prison for three months, though he denied all knowledge of the matter. At Dewsbury last week Hewitt was fined 19s. 6d. for assaulting a detective, and both men were committed to the next Quarter Sessions on a charge of fraud.

Compensation Claim Follows Fatal Shock.

IN the Hull County Court on November 12th, Thomas Drust, Hessle, claimed the sum of £150 from Messrs. Watshams. Ltd., Victoria Street, S.W.1, as compensation for the loss of his son, Sidney Drust, who received a fatal electric shock while in the respondents' employment.

Counsel for the applicant said that the claim was resisted on the grounds that the injury was not caused by an accident arising out of deceased's employment, and that the claimants were not dependent (wholly or partially) upon the deceased. The accident occurred while deceased was working on an overhead line. He had been instructed, with another man, to straighten a pole and was told to wait until a foreman arrived. To save time Drust did not wait, but climbed the pole to place a guy rope over the top. He came into contact with a 22,000-V line and was seriously burned and he fell and fractured his leg.

Evidence was given for the respondents to show that the deceased had neglected to observe his instructions, and that it was no part of his duty to climb poles. Moreover, the men had been warned that the line was "live."

Judge BEAZLEY, after hearing the evidence, reserved his judgment.

Theft of Copper Wire and Cable.

THREE men were sentenced at Ayr Sheriff Court on November 14th to 30 days' imprisonment each, and another to 40 days, for the theft of copper wire and cable from the Ayrshire Electricity Board's yard in Irvine on November 6th.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Telephone Developments.

On November 12th MR. D. G. SOMERVILLE asked the Postmaster-General if he could state at what date he expected that all exchanges in the London area would be converted to the dial system; what was the estimated aggregate cost and duration of the original conversion scheme; and what would be the additional cost as a result of its acceleration.

MR. LEES-SMITH said that, normally, the conversion of a manual to an automatic exchange did not take place until its capacity was exhausted or until the economic life of the plant had expired. The date of complete conversion of the London area to automatic working depended, therefore, to some extent on the rate of growth of the demand for telephones. About 130 exchanges were expected to be working on an automatic basis by 1940, when about 20 exchanges would remain for conversion. The programme was necessarily tentative, and while progress up to the present had been rather more rapid than was anticipated there had been no departure from the principles on which it was regulated. Any deliberate acceleration beyond the needs of the service would involve heavy wastage of capital. On the basis of present prices the expenditure on buildings and equipment for automatic exchanges up to 1940 would be of the order of £25,000,000, of which (for the reasons stated) a large part represented ordinary replacement and development liabilities which would be necessary under manual conditions.

MR. LEES-SMITH informed Mr. Ross that schemes were in hand for improving telephonic communication between Belfast and Glasgow, and the Northern Ireland portion of the work would begin next year. The total cost was estimated at £233,600 of which the Northern Ireland portion amounted to about £40,000, divided nearly evenly between duct work and cabling.

MR. BOWEN asked, whether the telephone construction works announced by the Lord Privy Seal were additional to the normal programme for the year.

MR. LEES-SMITH said that they were an acceleration. The authorised construction programme for the current year amounted to £10,500,000. Works estimated to cost £750,000 in addition to this authorised programme had now been sanctioned and would be put in hand forthwith.

On November 13th SIR F. THOMSON asked what was the sum that the Post Office had standing at the credit of telephone users on deposit for trunk calls.

Mr. VIANT, the Assistant Postmaster-General, said that the total amount held on deposit on September 30th, 1929, was £2,690,717. This covered local calls and phonograms as well as trunk calls.

Correspondence.

Correspondents should forward their communications as early as possible. ***No letter can be published unless we have the writer's name and address in our possession.***

The "All-Electric" House.

Your special issue of October 18th contains so much interesting matter that I have only to-day found time completely to digest it.

As one would anticipate, the "all-electric" house is well in the foreground, and I have been particularly intrigued by the articles appearing under the names of Professor S. Parker Smith and Mr. H. Willoughby Ellis.

The latter gentleman kindly presents me with a text for my few remarks when he says "no good purpose is served by remarking that the shoemaker's children always wear the most broken down boots; but it is a matter of common knowledge (and nothing to our credit) that electrical men have been woefully slow to set an example to the rest of the community in the matter of employing all-electric domestic service in their own homes."

It is evident that there must be some good reason for this action, or rather want of action, on the part of electrical men, and very respectfully I would submit that the reason lies in the fact that the majority of electrical engineers realise that with the present system of deriving electrical energy from coal, it may be said to constitute an offence against the rules of national fuel economy to use electrical energy for such pur-

poses as heating rooms and hot water supply. I need not quote to the readers of a technical electrical journal the actual percentage of heat units lost during the process of the generation of electricity from coal, as this is only too well known.

In the course of many discussions with electrical men in all branches of the industry I have, however, found to my intense surprise that this offence does not lie heavily on the consciences of many, and that, as a matter of fact, many electrical engineers consistently turn the blind side of their brain towards it.

However, the offence against national economy is borne out by the financial results, and I propose now to briefly refer to this aspect of the question.

The reading of Professor S. Parker Smith's classic paper in 1925 had a rather unexpected effect on me personally.

At that time I was considering the re-organisation of the domestic services in my house, which contains the same number of rooms as Professor Smith's, and, as a result of the figures given in the original paper, turned my face resolutely away from the "all-electric" house.

Instead, I adopted what might be called the "gas-coke" house. For use during the six months of winter, I installed in the kitchen a coke-fired boiler, which supplies hot water without stint for all purposes and at the same time feeds radiators in the hall, study, and bathroom. The radiator in the hall is of such dimensions as to be capable of keeping the general temperature throughout the house at about 50 deg. F. during the most arctic weather.

For use during the summer months when hot water supply only has to be considered, a small gas boiler takes the place of the large coke boiler.

In the dining room one coal fire still survives, largely for sentimental reasons. In the remaining rooms, not provided for by the radiators, gas fires are fixed. For cooking, a modern gas cooker fitted with a temperature regulator gives entire satisfaction to my wife, whose opinion on this point is the only one which matters. Light is provided by a small gas engine driving a little generator, which costs a ridiculously small amount for annual running.

Unfortunately, I am not able to give the results for five years, as the system was only put into service at the beginning of 1927, but I am able to give them for three years, 1927, 1928, and 1929. They are as follows:—

Coal, coke, firewood, and gas.

1927	...	...	...	£23 10 0
1928	...	...	...	25 4 2
1929	...	...	...	20 9 7
				£69 3 9
Average for three years			...	£23 1 3

The average cost in Professor S. Parker Smith's all-electric house, which is situated in a district which provides a supply of electricity at the phenomenally low price of .64d. per unit, is, roughly, £43.

Apart from the very substantial saving effected in annual cost, there is the advantage that no special means have to be provided for ventilation. The gas and coal fires provide naturally for ample air circulation. I note that in the all-electric flat described by Professor Smith it was necessary to block the flues in order to enable a sufficient temperature to be reached in the rooms.

In conclusion, I must express my admiration of the thorough and painstaking way in which Professor Smith has carried out his large-scale experiment on electric domestic service. If the electrical energy were produced economically by water or wind power, I should be most enthusiastic in my adoption of the same system in my own house.

It seems to me, however, that the first duty of an electrical man is to be an "engineer," and the definition of an engineer which appeals most strongly to me is "one who most efficiently utilises the resources of nature."

I feel strongly that it is not in the best interests of the electrical industry in the long run to push the use of electricity for heating purposes irrespectively of the method by which the electricity is generated, and am convinced that if this is done recklessly the chickens will come home to roost.

Frank J. Moffett.

Birmingham, *November 12th*, 1929.

Correction of Balance by Induction Motors.

My best thanks to your correspondent, "Delta," for his prompt and careful reply to my query in the ELECTRICAL REVIEW of October 18th *re* induction motors. It is the knowledge that such help is waiting which encourages those who, like myself, "come up against it" now and again to bring their difficulties forward.

Student.

November 11th, 1929.

Potential Connections for Automatic Voltage Regulators.

I have read with great interest the article on the above in your current issue, in which Mr. G. W. Stubbings describes how an unsymmetrical three-phase system comprises a symmetrical system plus a superimposed single-phase component representing the voltage drop due to the out-of-balance current, and gives particulars of a scheme of connections in conjunction with a voltage regulator for maintaining approximately average voltage on the three phases in the event of a large overload or short circuit between two phases.

It would be of interest to see how the single phase component is obtained, say, for unequal loadin' on two pairs of phases, and also for a short circuit between one phase and earth, when the earth is connected to the neutral point. The tendency of the regulator in any case would apparently be to give the alternator associated with it an increased voltage across one pair of phases to compensate for the drop on the other two.

As a matter of fact, I have always found that in the event of a short circuit a regulator has no time to regulate at all. The contacts simply come together and short circuit what resistance is connected between them, and simultaneously the faulty feeder or apparatus is tripped out, since in this country protective systems have attained a high degree of perfection, and are in general use.

It would appear, therefore, that during the few moments the short is "on" it would be more advisable to keep the voltage on the low side instead of feeding the fault with a higher voltage, and that, when perhaps a large load has been tripped off the generator as the result of the short circuit, the regulator should immediately respond to bring the voltage down to normal.

In an article on voltage regulators which appeared in the *Metropolitan-Vickers Gazette* of June, 1926—since reprinted in leaflet form—I described a device which limited the excitation of an alternator to a predetermined value during a short circuit on the system, and at the same time allowed the regulator to operate and keep the voltage down to normal upon the load tripping off. The usual single-phase control from one pair of phases is used, and the device is operative upon a sudden drop, or a sudden rise, in pressure, so that it is effective whatever the phase upon which the fault occurs. It has been found that the whole load may be tripped off an alternator after a severe short circuit without more than a momentary drop and rise of limited magnitude being recorded on the voltage chart.

H. E. Angold.

Streatham Vale, S.W.16.
November 12th, 1929.

Two-part Tariff Prepayment Meters.

The description published by you last week of the "Rex" two-part tariff repayment meter shows the latter to contain an ingenious mechanical contrivance, enabling supply authorities to collect only small fixed charges. The amount thus prepaid would often be sufficient to cover the rent of the meter, *viz.*, about 2s. per quarter, but would hardly ever result in the prepayment of sums as large as 10s. or £1 per quarter. Many meter engineers do not yet seem to realise that the object of a two-part tariff system is to increase the amount of electricity sold, by reducing the price of the kWh. It is then, of course, necessary to impose a fixed charge in addition to the unit charge. To reduce the unit charge from, say, 5d. to 1½d., it is necessary to make a fixed charge of about 15s. per quarter. In the meter described a consumer could insert, say, five shillings, half of which would go towards the fixed charge and half to cover the unit charge. At 1½d. per unit the consumer would thus be allowed to take 2s. 6d. divided by 1½d., *i.e.*, 20 units. With a little care this could be made to last out the quarter, and the collector would have to whistle for his 12s. 6d. I am afraid, therefore, that the "Rex" meter is unsuitable for this purpose, unless the authorities are content to ask for the odd twelve shillings of fixed charge still unpaid before closing the switch. In that case they would do better, of course, to use a non-prepayment meter. I find, on the other hand, that the A.E.G. supplies a real two-part tariff prepayment meter which "does the trick."

H. Horwood,

London, *November 11th*, 1929.

Electrical Thermal Storage.

I was most interested in the description of a "Large Thermal Storage Scheme" at the new headquarters of the London Underground Railways, which was in your issue of September 20th. There are lots of points, however, on which one would like information, or perhaps it would be better to say which one would like explained. I am naturally interested in this branch of the subject, as I made and installed the first hot-water system that I know of, and certainly the first in this country, in 1904. From all the experiments I have made, and from the installations I have put in, the large diameter squat cylinder has always been very low in efficiency. The majority of our own systems are put on the high-pressure mains, and all cylinders are tested to 300 lb. per sq. in. The 18½-in. diameter size has plates 9/32 in. thick, with dished ends 5/16 in. thick. The cylinders are galvanised inside and outside after manufacture. The largest installation carried out so far, of course, compares in no way with the one you describe, but it is for providing 1,000 gallons of very hot water every twenty-four hours.

Apparently no circulating tubes of any description are used in the cylinders, and one would have thought that a battery

of elements of such a high capacity as 336 kW would cause trouble.

I have found that the type of element described in the article is not at all satisfactory in this country, and it must be very inconvenient to have to replace a broken or burnt-out element. Our own experience with the direct immersion type has been a failure of eight out of 2,000. Some of the elements have been used continuously for fourteen years. There is another point one would like to have information on, and that is that the insulation round the tank appears to be far too thin, as we take it that the temperature of the incoming water will be as low as 40 deg. sometimes. We ourselves never use less than 6 in. of cork insulation on such a small storage system as 1,000 gallons. One would have thought that for such a large installation as this, the 11,000-volt, 3-phase system would have been used direct in the water, and it would be interesting to know the reasons for its non-adoption. It would also be very interesting indeed to hear if the efficiency of this system has been tested, and what it is. We get not less than 85 per cent. efficiency normally, and we have had as high as 89 per cent. efficiency.

The technical descriptions in a paper like the ELECTRICAL REVIEW are always most interesting to some of us who are supposed to be tucked away in the back veldt, but who are always looking for opportunities for keeping abreast with the times.

A. Vaux.
for ALBERT VAUX, LTD.

Cape Town, S. Africa.
October 25th, 1929.

[We forwarded an advance proof of the above letter to Messrs. Richard Crittall & Co., Ltd., whose reply is as follows. —EDS. ELEC. REV. :—]

We agree with your correspondent's remarks with regard to the inefficiency of large diameter squat cylinders. Those installed at Railway House, however, cannot be described in this manner, since their diameter is practically the same as their height; but in any case considerations of space in this instance determined the shape of the storage vessels. Our experience, supported by that of specialists in the manufacture of heat-insulating material, indicates that very little is to be gained by increasing the thickness of this special type of insulation beyond three inches. The same remark, of course, does not apply to less efficient forms of insulating material.

We also agree that for large installations of this kind there will be many instances in which the electrode type of boiler connected direct to the 11,000-volt system could be used. In this instance, however, the Underground authorities gave the matter very careful consideration, and for various reasons, into which it would not be possible to enter except at great length, decided to use a low-voltage immersion-heater system.

Richard Crittall & Co., Ltd.,
D. BETTS, *Sales Manager.*

London, *November 12th*, 1929.

Cross Field of Single-phase Motors.

I was interested to read the letter on this subject from "Eee Bee" in your issue of November 8th. The difficulty which he mentions is one which I recollect coming up against myself, and doubtless many others have noted it, although I have not before seen it stated in print.

Unfortunately many text-book writers content themselves with a rather superficial explanation of the theory of the single-phase induction motor, and do little more than call attention to the fact that the movement of the rotor conductors in the stator field is instrumental in setting up a cross field. The student is left to reconcile as best he can with this statement the fact that owing to the angular movement of such conductors, combined with the lag between current and voltage in them, such a voltage of rotation would, apparently, give rise to a flux which would be in opposition to, and not at right-angles to, the main field.

It is not intended for a moment to imply that the writers of such text-books themselves fail to understand the theory of such a motor, but, unfortunately, an explanation sufficiently full and complete to make the matter clear to the majority of students takes up a very considerable amount of space, which many writers might be more ready to devote to it if they realised how much the condensed explanation sometimes serves to mislead.

Perhaps the following explanation, necessarily very incomplete, may serve to put your correspondent on the right track to a solution :—

In this the rotor conductors are assumed to be separated into two bands, at right angles to one another, and to be rotating at synchronous speed in the alternating flux set up by the stator windings. Owing to the high inductance of the rotor conductors, currents induced in these lag 90 degrees behind the e.m.f.'s.

By following out the currents and e.m.f.'s induced in each belt of conductors during one complete revolution, it can be seen that these currents, being in conductors which are mutually at right angles to each other, and being out of phase by 90 degrees, set up a rotating field, the direction of rotation of which is opposite to that of the rotor itself. This can best be followed out by drawing a series of simple diagrams showing the two belts of rotor conductors in eight different positions during one revolution; the direction of magnetisation of the current in each case being indicated by a vector.

Such a rotating field can itself be resolved into two alternating components, one at right angles to, and one in opposition to, the stator field. That in opposition can be subtracted from the main field, and for the moment disregarded; that at right angles combines with the stator field, as though set up by the second phase of a two-phase motor, forming a true rotating field whose direction of rotation is the same as that of the rotor.

For the motor to develop a torque sufficient to overcome losses when running light, it must, of course, rotate at a speed slightly below synchronism.

The matter is too complicated to be dealt with in a satisfactory manner in so small a space, but the above may serve to indicate what is probably the most satisfactory method of approaching the problem.

C. Coppock.

London, W.C.1.
November 11th, 1929.

The Evolution of Railways.

From September 14th to September 21st, 1930, Liverpool will be celebrating the centenary of the opening of the Liverpool-Manchester railway. From this railway sprang, of course, the first great railway system, the London & North Western, from which developed the huge network of railway systems which has spread all over the world.

Included in the scheme are special pageants, both railway and civic, a comprehensive "Evolution of Transport" procession, and two exhibitions. Of these exhibitions, the first will comprise the heavier exhibits—railway locomotives, rolling stock, &c.—dating from the beginning of railway history. The second will comprise railway posters, historical literature, railway prints, etchings, and models.

The executive committee—which consists of representatives of the civic and railway interests—would be grateful for information from everyone who could supply information as to the whereabouts of historical exhibits, or who would be prepared to lend such exhibits.

Communications should be addressed to me at the undermentioned address.

Arthur Stery,
General Secretary,
LIVERPOOL-MANCHESTER RAILWAY CENTENARY CELEBRATIONS COMMITTEE.

357, Royal Liver Building, Liverpool.
November 15th, 1929.

Meter Jewels.

The main object of our letter was to point out that the statistics given by the author proved conclusively that oiled meter jewels were far superior to dry ones, in spite of his own opinions on the matter. This anomaly was mentioned in the I.E.E. discussion.

The theory put forward, that the oil film does not remain under the pivot owing to the weight of the rotor and small pivot surface, has been exploded by an experiment of Prof. Schachenmeier at the A.E.G. Meter Laboratory.

The above-mentioned statistics certainly support the results obtained from this experiment.

A.E.G. Electric Co., Ltd.

London, *November 15th*, 1929.

Selling Time Switches.

With reference to the E.D.A. meeting on Friday of last week, when salesmen were advised to learn the many applications of the use of time switches, I should like to point out that after the salesman has learnt the more useful attributes of his profession, *i.e.*, cookers, water heating, all kinds of domestic appliances, types of fittings for various house decoration schemes, wiring requirements, to service the appliances, &c., &c., he might be able to turn his attention to time switches.

One of the speakers enjoined salesmen to learn the art of public speaking, pointing out that he had addressed an electricity department's meeting where approximately 150 people gathered to hear him.

To get to the point, if the headquarters of the E.D.A. can only muster a gathering of 60 people, and a small town can command 100 to 150, the E.D.A. has surely something to think about other than advising people on abstruse time switches and the art of public speaking.

Anyone going along the Old Kent Road must notice there is a tremendous field for instructing people in the desirability of the use of electric lighting.

Can we not have subjects of rather more pressing importance than those given at the last two addresses? The gatherings may otherwise dwindle down to zero.

I do not mean to imply that the speakers were poor; indeed, anyone knowing Mr. Sharp, knows that he is delightful.

F. A. Dracup,
Sales Manager, ELECTRICITY DEPARTMENT,

Eastbourne, *November 16th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

11,606. "Sound-reproducing machines." A. F. Sykes. April 19th, 1928. (320,868.)
11,712. "Magnetic alloys." Siemens & Halske Akt. Ges. May 20th, 1927. (290,658.)
11,853. "Variable condensers." L. Rcuzet. May 10th, 1927. (290,219.)
11,985. "Automatic regulation of the power factor in electric alternating-current systems." Switchgear & Cowans, Ltd., and D. Firth. April 24th, 1928. (320,897.)
12,38.. "Secondary electric cells." L. A. Levy and Almeida Accumulators. April 27th, 1928. (320,916.)
12,456. "Intermittently-illuminated direction indicators for motor vehicles." B. Hibbert. April 28th, 1928. (320,917.)
15,005. "Controlling arrangement for electric ship propulsion systems." Akt. Ges. Brown, Boveri et Cie. May 25th, 1927. (281,056.)
15,460. "Methods of producing printing plates by electro-chemical processes." Dr. C. Schinzel. May 25th, 1927. (291,063.)
17,781. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. June 19th, 1928. (320,849.)
17,886. "Automatic electric circuit controllers." E. Kieback and P. Peter (trading as Kieback & Peter Messgerate und Regler, Dipl. Ing., firm of)). June 21st, 1927. (292,538.)
17,933. "Mercury-arc rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. June 20th, 1928. (320,850.)
18,287. "Thermionic valve modulation circuits." Siemens & Halske Akt. Ges. June 24th, 1927. (292,626.)
18,293. "Automatic telegraphic reperforators." Muirhead & Co., Ltd., F. H. Muirhead, and J. V. Foll. June 23rd, 1928. (320,870.)
18,500. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. June 27th, 1927. (292,957.)
18,657. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. June 27th, 1927. (292,960.)
20,825. "Electric switches." A. D. Constable and A. E. Frankling. July 18th, 1928. (320,857.)
21,142. "Motion-picture apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (320,872.)
21,172. "Systems of control for alternating-current electric motors." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 21st, 1928. (320,889.)
21,209. "Electric lighting and installations for railway and like vehicles." J. Stone & Co., Ltd., and A. E. Honey. July 21st, 1928. (Cognate application 6,331/29.) (320,922.)
21,305. "Switch arrangement for line intercommunication switches with multiple lines." F. Merk. July 23rd, 1928. (320,923.)
21,314. "System and apparatus for the electrical recording and reproducing of sound." A. J. Stephens (M. H. Loughbridge). July 23rd, 1928 (320,893.)
21,315. "Systems for recording and reproducing pictures and sound." A. J. Stevens (H. T. Leeming). July 23rd, 1928. (320,900.)
21,323. "Cascading apparatus, comprising a series of rotatable retarders." R. V. Faraham. July 23rd, 1928. (320,874.)
21,332. "Switching apparatus, particularly applicable to automatic telephone systems." F. Merk. July 23rd, 1928. (320,875.)
21,336. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 23rd, 1928. (320,876.)
21,337. "Electric fuses." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 23rd, 1928. (320,895.)
21,346. "Electric plug-and-socket contacts." K. Schnell. October 6th, 1927. (298,219.)
21,445. "Time-controlled and operated electric switches." J. D. Hindley Smith and S. H. Holmes. May 24th, 1929. (320,813.)
21,505. "Alternating-current motors." H. Weichsel and B. McCormick. July 24th, 1928. (320,901.)
21,545. "Two-position non-spill galvanic cells." Three Star Accumulators, Ltd., and F. C. Grund. July 25th, 1928. (320,903.)
21,553. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., E. P. G. Wright, J. H. E. Baker, and C. M. Colebrook. July 25th 1928. (320,905.)
21,578. "Control apparatus for combined electric lighting and heating or like installations." A. C. Johnson. July 25th, 1928. (320,908.)
21,615. "Induction dynamo-electric machines." J. F. Gill and J. N. Chaviara. July 25th, 1928. (320,931.)
21,707. "Earthing devices for the metallic sheathings of electric resistance elements." Hotpoint Electric Appliance Co., Ltd., and W. J. Sims. July 26th, 1928. (320,936.)
21,732. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Taylor, and L. M. Simpson. July 26th, 1928. (320,938.)
21,874. "Apparatus for forming the depolarising element of primary electric cells." V. E. Richards. July 27th, 1928. (320,942.)
21,879. "Wireless receiving and analogous circuits, and thermionic valves therefor." F. E. A. B. Sewell. July 27th 1928. (Cognate applications 22,287/28 and 6,835/29.) (320,944.)
21,934. "Telephone transmitters." Standard Telephones and Cables, Ltd., L. C. Pocock, and R. Blackburn. July 28th, 1928. (320,950.)
21,976. "Band receiving systems for wireless-telephony and the like." Vreeland Corporation. August 1st, 1927. (294,939.)
22,163. "Telephone systems." Associated Telephone and Telegraph Co. October 21st, 1927. (299,033.)
22,211. "Cathode-ray oscillographs." E. H. Norinder. August 9th, 1927. (295,321.)
22,217. "Electric protective systems." A. Reyrolle & Co., Ltd., H. Leben, and N. Cooke. July 31st, 1928. (320,968.)
22,218. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. Leben. July 31st, 1928. (320,969.)
22,436. "Electromagnetic couplings." A. Lindahl, A. M. V. Hultgren, and S. H. Ahde. November 3rd, 1927. (299,864.)
23,153. "Electromagnetic devices for reproducing sound from records." S. G. Brown. August 10th, 1928. (320,981.)
23,309. "Manufacture of electric batteries." A. Helbronner and E. Dutt. August 11th, 1927. (295,589.)
23,319. "Magnetos." Wico Electric Co. April 9th, 1928. (309,401.)
24,349. "Devices for the electrical treatment of poultry." O. G. Culverwell. August 24th, 1928. (320,992.)
24,391. "Television system incorporating transmitting and receiving apparatus with cathode rays." D. N. Sharma August 24th, 1928. (320,993.)
24,434. "Method of introducing highly-active metals into sealed containers." Westinghouse Lamp Co. September 9th, 1927. (296,781.)
24,686. "Television." J. S. Shinton. August 28th, 1928. (320,999.)
25,372. "Mercury lamps." J. Harden. September 4th, 1928. (321,003.)
25,903. "Electrical heating and mixing apparatus." Drysdale & Co., Ltd., and J. Young. September 10th, 1928. (321,006.)
25,973. "Transformers for use in rectifier installations." Akt. Ges. Brown, Boveri et Cie. September 10th, 1927. (296,996.)
27,667. "Method of, and arrangement for transmitting wireless signals." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 26th, 1928. (321,025.)
27,875. "Coil-driven loud-speakers." C. J. Nesbitt-Dufort and O. & S. Oilless Bearing Co., Ltd. September 28th, 1928. (321,027.)
28,081. "Tubular electric incandescent lamps." E. R. Grote. October 1st, 1928. (321,032.)
28,449. "Thermionic valves or vacuum-electric devices." W. Holt. October 4th, 1928. (321,037.)
29,457. "Combined television and sound-reproducing apparatus." S. F. Warren. October 12th, 1928. (Cognate application 36,212/28.) (321,043.)
30,547. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. October 21st, 1927. (299,325.)
30,640. "Devices for the generation of audio-frequency electric currents." Coventry Automatic Telephones, Ltd., and E. P. L. Westell. October 23rd. 1928. (321,052.)
31,498. "Graphite and depolariser plates for galvanic cells." Siemens and Halske Akt. Ges. October 31st, 1927. (299,784.)
31,816. "Polyphase asynchronous motors." Siemens-Schuckertwerke Akt. Ges. November 4th, 1927. (299,886.)
32,529. "Electrical heating device." S. Thompson. November 7th, 1928. (321,065.)
34,373. "Thermionic valves and the like discharge devices." Telefunken Ges. für Drahtlose Telegraphie. December 6th, 1927. (301,827.)
34,742. "Manufacture of electric incandescent lamps or the like." General Electric Co., Ltd. November 28th, 1927. (301,389.)
34,801. "Cathodes for electron-discharge devices." Dr. A. Just. July 30th. 1928. (316,536.)
34,849. "Reflector arrangement for incandescent lamps." S. K. Olsen (trading as L. Poulsen & Co.). November 24th, 1927. (Addition to 280,351.) (301,332.)
36,087. "Fluid-filled paper-insulated electrical cables." W. Brown. December 7th, 1928. (321,088.)
36,318. "Automatic light-changing mechanisms for lighthouses." Austinlite, Ltd. December 10th, 1928. (321,091.)
37,540. "Incandescent electric lamps." G. Main. December 23rd, 1927. (302,917.)
37,971. "Picture and the like telegraph systems." A. Carpmael (Telefungen Ges. für Drahtlose Telegraphie). December 22nd, 1928. (321,104.)

1929.

240. "Electric switches." A. Stuppock and G. Hager. January 3rd, 1928. (303,450.)
850. "Electric motors." Magneto Belge. July 13th, 1928. (315,384.)
1,038. "Miners' electric lamps." J. G. Daloz. July 27th, 1928. (316,281.)
1,571. "Twin and multi-core electric cables." St. Helens Cable and Rubber Co., Ltd., and H. C. Harrison. January 16th, 1929. (321,118.)
3,995. "Electric lamps for the production of ultra-violet rays." W. D. Verschoyle. February 6th, 1929. (Addition to 312,591.) (321,124.)
4,384. "Relay and selector arrangement in telephone installations." F. Merk. March 5th, 1928 (307,340.)
5,041. "Electric discharge devices." Telefunken Ges. für Drahtlose Telegraphie. March 14th, 1928. (307,826.)
5,108. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. February 15th, 1928. (306,099.)
5,266. "Television apparatus." J. L. Baird and Television, Ltd. April 25th, 1928. (Divided application on 320,639.) (320,909.)
5,894. "Electric lampholders." J. B. Taunton. February 22nd, 1929. (321,131.)
7,060. "Means for the synchronisation of broadcast wireless sounds and kinematograph films." C. H. Verity. July 23rd, 1928. (Cognate application 7,061/29.) (320,881.)
9,420. "Television apparatus and the like." J. L. Baird and Television, Ltd. May 31st, 1928. (Divided application on 318,278.) (321,136.)
17,733. "Methods of electrolytically depositing chromium." Soc. Chimique de la Seine and V. Szidon. July 28th, 1928. (Divided application on 320,440.) (320,959.)
20,513. "Method of and apparatus for starting and controlling electric motors." Brookhirst Switchgear, Ltd., and J. A. Hirst. June 16th, 1928. (Cognate applications 20,133/28 and 20,514/29.) (Divided application on 320,615.) (320,882.)
25,955. "Television and like systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). April 26th, 1928. (Divided application on 318,100.) (320,961.)
30,430. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. June 19th, 1928. (Divided application on 320,849.) (320,866.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 13th :—

Livejuce (lettering and design). No. 506,025. Class 1. Electrolyte for lead-plate electric storage batteries.—The Livejuce Manufacturing Co., 42, South Lambeth Road, S.W.8.

Isomone. No. 504,019. Class 8. Parts of wireless telephonic apparatus.—Haw & Co., Ltd., 845-850, Salisbury House, London Wall, E.C.2..

Viva-Radio. No. 505,387. Class 8. Instruments and apparatus for use in connection with wireless telephony and telegraphy, and wireless telephonic apparatus in combination with gramophones.—The Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, E.C.1.

Folio. No. 490,085. All goods in Class 11.—Siemens-Schuckertwerke Gesellschaft, 101-110, Noonendammallee, Siemensstadt, Berlin, Germany. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Remediolux. No. 506,396. Class 11. Electrical apparatus for use in the production of high-frequency violet rays for surgical or curative purposes.—John W. Vernon, trading as the Cromford Textile Agencies, Cromford House, Crown Place, Market Street, Manchester.

Valunda. No. 506,104. Class 13. Electric switches.—Frederic R. Francke, 28, Blomfield Road, Maida Vale, W.9.

Chaolit. No. 506,055. Class 50. Lamp shades.—Melon J. D. Carter, 25, Cleveleys Road, Upper Clapton, E.5.

Effect of Drought on Water Power in U.S.A.

According to a review by the Statistical Research Department of the National Electric Light Association (U.S.A.), the generation of electricity by water power in September this year was only 31 per cent. of the total output. This is the lowest proportion since the dry weather period of October, 1925, and compares with a proportion of 43 per cent. in May, and 38 per cent. in September, 1928. During the month in question the total hydro-electric production was 12¼ per cent. below that of August and 12 per cent. below that of September, 1928. The effect of the reduction in generation by water-power plant is reflected in the fact that 2,600,000 additional tons of fuel have been consumed by the fuel stations in the country during the last few months.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHFORD (Kent).—Additional 65 houses, for the U.D.C.; surveyor

AYR.—Houses (200), for the Corporation; burgh surveyor.

BARNET.—Electric lighting installation at Byng Road school, for the Hertfordshire C.C. (£150).

BEACONSFIELD (Bucks.).—Extensions, film studios, for the British Lion Film Corporation.

BENFIELDSIDE.—Remodelling two schools (£11,000); Durham county education architect.

BEXLEY (Kent).—Business stores, Broadway, for F. W. Woolworth & Co., Ltd., Kingsway, London. Houses (60), Long Lane, for Cox Bros., Maidstone. Houses (35), for D. C. Bowyer; A. H. Jennings, architect.

BEXLEY.—Houses (42), Wickham Street, for J. Stevens and Sons; A. Hargreaves, architect.

BILSTHORPE.—Conversion of institute to cinema; Stanton Ironworks Co., Ltd.

BILSTON.—School, Proud's Lane and Mountford Lane; A. F. B. Sidwick, surveyor to U.D.C., Town Hall.

BIRMINGHAM.—Hotel, Yardley Wood Road, for Ansell's Brewery, Ltd.; H. W. Hobbiss, 33, Newhall Street.

BLACKPOOL.—Hospital, Whinney Hall Road, for the Board of Management, Victoria Hospital (£100,000); J. Gibson & Gordon, architects, 5, Old Bond Street, London, W.1. Rebuilding Royal Oak Hotel, Lytham Road and Waterloo Road, for Catterill & Swarbrick's Brewery; Sir Lindsey Parkinson & Co., contractors, Talbot Saw Mills.

BOLTON.—School and parochial hall; rector of St. Mary's R.C. Church, Palace Street.

BOSTON.—School, Skirbeck; Lindsey E.C. Hospital blocks (£7,000), for the Fever Hospital Joint Committee; borough surveyor.

BRAINTREE.—Electric lighting installation, Institution, for the Board of Guardians; clerk. Weaving shed; Warner and Co. Business premises, Bank Street, for F. W. Woolworth & Co., Ltd., Kingsway, London, and Freeman, Hardy & Willis, Ltd., Leicester.

BRIGG.—Alterations and additions to the Grammar School (deposit £3 3s.); H. G. Gamble, county architect, Lincoln

BROADSTAIRS.—Refuse disposal works, with electrical work (£8,598), for the U.D.C.; surveyor.

BROMLEY (Kent).—Housing scheme (60), for the R.D.C.; surveyor.

CLIFTON (Yorks.).—School (400 places), for North Riding E.C.; director of education, Northallerton.

CONSETT.—Houses (50); U.D.C. surveyor.

COULSDON.—Premises, Chipstead Valley Road; Watney, Combe, Reid & Co., Ltd.

CROYDON.—Additional housing schemes (744), for the T.C.; borough engineer.

DARLINGTON.—Employment exchange (£9,500), for H.M. Office of Works, King Charles Street, London, S.W.

DARTFORD.—Additional housing scheme (166), for the R.D.C.; surveyor.

DARWEN.—New central shopping area, Market Street area: borough surveyor.

DEVON.—Schools (40) (£320,000), for the E.C.; J. F. Young, secretary, Exeter.

DUDLEY.—Dairy, Priory estate (£20,000), for the Dudley Co-operative Society, Ltd.

DUNMOW (Essex).—Housing scheme (68), for the R.D.C.; J. Plumbley, surveyor, 58, New Street (returnable deposit of £1 1s.).

EDINBURGH.—Buildings at Bellevue Technical School (£11,000); master of works, Education Authority. Synagogue (£22,000); the Rabbi, Edinburgh.

FINEDON.—School, with clinic, for Northants. E.C.; R. J. Williams, architect, Market Street, Kettering (returnable deposit of £2 2s.).

FLEETWOOD.—Bank premises, Lord Street, for Westminster Bank, Ltd.; Lumb & Walton, 19, Clifton Street, Blackpool.

GLASGOW.—College premises, Pitt Street, for the governors, Glasgow and West of Scotland Agricultural College. Cinema, Ardmay Crescent, King's Park; Robert F. M'Math.

GRANTHAM.—School, for Kesteven E.C.; education architect, Sleaford.

GRAVESEND.—Reconstruction, West Street area; borough engineer.

GREAT CHART (Ashford, Kent).—Electric lighting installation, Parish Church; Rev. N A. Holt, vicar.

GREENOCK.—R.C. school; executive officer to the Renfrewshire Education Authority.

GUILDFORD.—Houses (44), Westborough estate; borough engineer.

HAMPSHIRE.—Extensions, mental institutions; county architect.

HEMSWORTH.—Laundry, with electrical work, for the Joint Hospital Committee; W. T. Lynam, R.D.C. surveyor.

HOUGHTON-LE-SPRING.—Housing scheme (36), for the U.D.C.; surveyor.

HOYLAKE.—Housing scheme; Hoylake and West Kirby Housing Society, Ltd.

HULL.—Eight schools; director of education.

HYLTON (Co. Durham).—Aerodrome; Air Ministry.

ILMINSTER.—Factory, Hort Bridge, for the Ilminster and District Farmers' Co-operative Society; secretary.

IRISH FREE STATE (Limerick).—Conversion, with heating and lighting work of Clarina Castle, to tuberculosis hospital, for the County Board of Health.

(Dublin).—Electrical installation at city abattoir, North Circular Road; F. McArdle, architect, 29, Rosemary Street, Belfast (returnable deposit of £3 3s.).

(Donegal).—New St. Patrick's Memorial Church of the Four Masters; Wm. H. Byrne & Son, architects.

KESWICK.—Sewage disposal works (£17,900); surveyor to U.D.C.

KETTERING.—Re erection of factory, Wood Street, for Loake Bros.

KINCARDINESHIRE.—School at Laurencekirk; clerk, education authority, Laurencekirk.

KIRKCALDY.—Houses (100), for the Corporation; burgh surveyor.

LONDON (Bethnal Green, E.).—Reconstruction, Wilmot Street school (£21,688); L.C.C. architect.

(West Ham, E.).—School (1,200 places), Canning Town, for the borough E.C.; C. E. Cranfield, clerk, 95, The Grove, Stratford, E.

(Islington, N.).—Buildings, Essex Street; B. L. Sutcliffe.

LUTTERWORTH.—Additional housing scheme (40), for the U.D.C.; surveyor.

MALDON (Essex).—Housing scheme (95), for the R.D.C.; William Almond, engineer.

NEWBARN (Co. Durham).—R.C. school (200 places); Rev. F. W. Savory.

NEWCASTLE-ON-TYNE.—County offices (£90,000); architect, Northumberland County Council, Moothall.

NORTHAMPTON.—School, Bective estate, for the E.C.

NORTH BERWICK.—Cinema (1,100 seats); burgh surveyor.

OSWESTRY.—Houses (50), St. Martin's, for W. Y. Craig and Sons, Ifton Colliery, St. Martin's.

PORTSMOUTH.—Church, Penarth Avenue, Cosham; Portsmouth Diocesan Church Extension Committee.

PURLEY.—Houses (60), Hadyn Avenue; Old Lodge Estates, Ltd.

ROMFORD.—Shopping arcade, South Street; Harrington and Evans, architects, 10, High Street. Houses (68), for P. H. Evans.

SCUNTHORPE.—Senior school, Ashby, for the Lindsey E.C.; director of education, Lincoln.

SKEGNESS.—Senior school, for Lindsey E.C.; director of education, Lincoln.

SLEAFORD.—Extensions to county offices (£8,000), for Kesteven C.C ; county architect.

STONEHOUSE.—School, for Lanarkshire E.C.; director of education, Glasgow.

TUNBRIDGE WELLS.—Schools (£11,000); Rev. Canon A. W. Oliver.

WALSALL.—Houses (132), for the T.C.; George Inslev. Ltd., builders.

WARWICKSHIRE. — Nurses' home, mental hospital (£13,330); county architect.

WELWYN GARDEN CITY.—Housing scheme (200), for the U.D.C.; surveyor.

WINCHESTER.—Houses (50), with electrical work, for the T.C.; F. G. Bursill, builder, Warwick. Central depôt (£2,245), for the T.C.; city engineer.

WITHAM (Essex).—Housing scheme, for the U.D.C.; D. Jenkinson, surveyor (returnable deposit of £2 2s.).

WOLVERHAMPTON.—Erection and repair shops, with warehouse and electrical eequipment (£500,000), for the Great Western Railway Co.; engineer.